Understanding the role of peer-to-peer accommodation in disrupting the neighbourhood: A new form of gentrification?

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A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

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Sep 2024

Abstract

The development in online transaction platforms has enabled the growth of peer-to-peer (P2P) accommodation services globally. This emergent phenomenon has disrupted traditional tourism and hospitality sectors since the global economic downturn around 2010. Platforms like Airbnb have capitalised on technological advancements and shifts in consumer preferences and for some to democratise lodging choices, sparking considerable academic interest. Such interest principally focuses on how the rise of P2P accommodation fosters urban economic and tourism growth, establishing competition with hotel offerings and tourism practices. The business model has contributed to urban economies whilst also identified as a trigger for a new wave of gentrification through shifting neighbourhood dynamics and property values. The UK has a vibrant and diverse tourism sector and is a leading country in the sharing economy. It appears P2P accommodation, taking housing resources away from the housing system, has potentially aggravated the existing housing crisis in the UK due to the deregulation of short-term rentals. This phenomenon calls for scholars to develop new theoretical frameworks and empirical strategies to better understand the processes and outcomes underpinning the sharing economy in different urban contexts.

This research seeks to provide an exploratory examination of the new form of gentrification prompted by P2P accommodation, via a study of three major UK cities. The thesis focuses on three key components. Initially, the spatio-temporal characteristics, rent gap opening, and neighbourhood profiles are analysed. These findings show that Airbnb in the UK revealed a rapid growth in listings since 2015, especially in Greater London, which challenges the housing and long-term rental sectors. Airbnb thrives, notably around central tourist locations and is spreading to the outskirts of major urban centres, showing varied spatial patterns depending on city size. The platform has introduced large rent gaps, with Airbnb revenue surpassing long-term rentals, particularly in central tourist districts. Urban centres such as Greater London and Greater Manchester see the largest rent gap driven by their cultural and international character, with student-heavy locales like Bristol also significantly affected.

Secondly, employing repeat sales design and multi-level modelling, it is possible to look at the impact of long-term occupied Airbnb on neighbourhood housing prices at the neighbourhood scale. The approach reveals how Airbnb's location and effect has a distinct decentralisation gradient. Central urban areas, with their stable housing markets, experience less Airbnb-induced price inflation compared to suburbs where limited housing stock makes them more vulnerable to price hikes due to Airbnb scarcity effects. The penetration of Airbnb into smaller flat properties exerts a greater impact on housing prices than house-type Airbnb,

although this also fosters gentrification, eroding traditional residential communities. This intricate pattern also underscores the socio-spatial disparities, where the shock of Airbnb is particularly disruptive in central and deprived areas.

Finally, the research explores Airbnb under the COVID-19 pandemic period, focusing on Greater London. Here the Airbnb market experienced a notable contraction, particularly in the central regions, as part-time hosts left and listings in high-income or tourism-reliant areas declined. Professional hosts owning multiple properties weathered the storm adeptly, repositioning their offerings to suburbs and upscale districts to mitigate revenue disruptions. The pandemic altered the dynamics of Airbnb revenue with a new preference for locations offering green spaces and retail amenities. Nonetheless, the presence of high revenues surrounding certain deprived neighbourhoods in the central and western parts of London provides compelling evidence of the perpetuation of gentrification driven by Airbnb.

Through these empirical contributions, the thesis offers a new and novel understanding of the disruptions of Airbnb to neighbourhoods and local housing markets and the deepening spatial inequality induced by Airbnb before, during and after the COVID-19 period.

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CHAPTER 1
INTRODUCTION

1.1 Research context: The sharing economy, touristification and platform urbanism

In the wake of the global financial crisis, the concept of the sharing economy emerged prominently around 2010, capturing the keen interest of investors worldwide. This innovative business model, with its promise of leveraging underutilised resources, proved particularly attractive in a climate of economic austerity (Kathan, Matzler, & Veider, 2016). The United States, China, and Europe have pioneered in this nascent economic landscape, leading the charge in terms of the scale of sharing economy businesses and finance. The financial commitment to this sector has been substantial, with total transactions in Europe's main sectors of the sharing economy being €28 billion in 2016 and are projected to increase to €570 billion by 2025 (PwC, 2016). The sharing economy phenomenon is recognised in many sectors such as accommodation, travel, car sharing, finance, etc., signalling a pervasive integration into the economic fabric (Puschmann & Alt, 2016; Geron, 2013).

Prior to COVID-19, the travel and tourism sector featured prominently in the global economy, accounting for approximately 10.3% of the worldwide GDP in 2019 (World Travel and Tourism Council, 2019). Recent statistics from developed nations indicate a surge in self-guided travel, which comprised more than 70% of all journeys (Postma, Buda, & Gugerell, 2017). This shift in travel behaviour has been largely facilitated by advancements in ICT, which has enabled the emergence of online platforms for the trade of travel information (Cohen & Kietzmann, 2014). Traditional intermediaries (e.g. travel agencies) are bypassed by platforms that can directly connect consumers and suppliers (Buckley et al., 2015; Minghetti & Buhalis, 2010; Buhalis & O'Connor, 2005), making self-guided travel simpler and safer to navigate. This development has triggered a notable shift in the industry towards harnessing demand-oriented technologies for fostering peer-to-peer (P2P) and dynamic interactions in more informal settings (Shabrina, Buyuklieva, & Ng, 2020; Oskam & Boswijk, 2016).

Trends in technology, finance and tourism have provided fertile ground for new short-term vacation rental platform-based companies such as Airbnb and VRBO. These platforms have responded rapidly to the evolving accommodation needs and preferences of modern tourists, offering a more flexible and personalised travel experience. As the market leader in the short-term rental platforms, Airbnb

generates additional revenue from renting out rooms or houses, levying a service fee of 10% of the turnover as the company's main source of profit. The potential economic, social and cultural benefits offered by Airbnb attract guests and hosts to use the platform, in turn creating value for both sides (Langley & Leyshon, 2017; Sundararajan, 2017). In the aftermath of the economic stumble, precipitated by diminished income levels and escalating unemployment rates, saving money and increasing income became a pressing concern for many (Dogru, Mody, & Suess, 2019; Zervas, Proserpio, & Byers, 2017; Fang, Ye, & Law, 2016; Guttentag, 2015). In this context, both landlords and tenants have reaped benefits from the premise that home-sharing platforms remove barriers to trust (Hamari, Sjöklint, & Ukkonen, 2016). In addition, there has been a shift in focus from owning new products to trying to tap into the residual value of vacant homes and turn that value into financial gain (Giana M. Eckhardt & Fleura Bardhi, 2015). P2P accommodation represented by Airbnb has greatly altered people's habits, with individuals now embracing a fast-paced, technologically advanced, and even fashionable lifestyle (Gansky, 2010). As a form of disruptive innovation, P2P accommodation has emerged as a vital tool for optimising the usage of lodging resources and revitalising rural tourism. This innovation is not merely a trend, but rather a harbinger of paradigm shifts in property management models.

The proliferation of shared accommodation is intrinsically linked to the impetus behind touristification. This process manifests with varying degrees of intensity and implications across global regions, including London, Paris, Italy, Spain, and Japan — cities that are wrestling with the fallout of a significant tourist influx. In recent years, the tourism sector has undergone rapid changes as it extends its reach across various social groups and incorporates nations into the collective worldview. The UNWTO (2023) reported a strong rebound in international tourism throughout 2022 despite a challenging economic climate. The UK is also facing the looming shadows of overtourism, with its associated challenges becoming increasingly apparent. In 2022, despite the aftermath of COVID-19, the UK welcomed 31.2 million international visitors (VisitBritain, 2023). Tourist hotspots, including Bath, Bristol, and Cambridge, are experiencing escalating pressures from tourism, prompting concerns among local authorities about the sustainability of such trends, which in the foreseeable future “may inundate the city overwhelming its resources”. This surge in tourism comes with multifaceted challenges. The burgeoning numbers of visitors can lead to extreme congestion, adversely impacting local residents who bear the brunt of temporary and seasonal tourism peaks. These influxes can enforce enduring alterations to community lifestyles, accessibility to facilities, and overall well-being (Butler & Dodds, 2022; Mihalic, 2020).

Overtourism evolves from the rapid expansion of unsustainable mass tourism activities, which consequently results in the harmful exploitation of urban, rural,

and coastal environments for tourism purposes (Milano, Novelli, & Cheer, 2019). The platform economy aims to create a sustainable development of society. Although the underlying concept of home-stay is traditional, its digitisation has transformed the practice into a tangible phenomenon (Söderström & Mermet, 2020), elevating it to a primary urban consideration across contemporary metropolises.

These P2P services signify the essence of 'platform urbanism', a movement where platforms transform homes into hotels, redefining urban spaces and economic patterns — a prime example of platform placemaking. As enablers of techno-capitalism, they disrupt real estate and hospitality sectors with tech-driven business models, often bypassing traditional regulatory frameworks (Langley & Leyshon, 2017; Sadowski, 2020). These digital platforms capitalise on valuable urban data on residential and tourist activities, which are instrumental to their business tactics and beneficial for urban planning endeavours. Municipalities may use the platform's comprehensive analytics for strengthened regulatory compliance and enforcement. Yet, the centralisation of data ownership fosters debates surrounding privacy rights and the equitable distribution of profits derived from such data (van Doorn, 2020). Hence, P2P platforms are not only reconstructing the physical layout of cities but also modifying the underlying policy framework and economic principles that steer urban development.

As the impact of P2P accommodation on global cities becomes increasingly evident, it has captivated the academic world's attention regarding its effects on the real estate market and the tourism sector. The academic discourse now touches upon various aspects associated with P2P accommodation, such as its advantages and challenges (Oskam & Boswijk, 2016; Cassell & Deutsch, 2020), regulatory and legal concerns (Palombo, 2015; Stemler, 2016), the determinants of spatial distribution and pricing mechanisms (Deboosere et al., 2019; Abrate, Sainaghi, & Mauri, 2022), its implications for the traditional hotel industry (Zervas, Proserpio, & Byers, 2017), and broader issues like touristification and gentrification (Wachsmuth & Weisler, 2018; Neuts, Kourtit, & Nijkamp, 2021). In the UK context, authorities have generally adopted a laissez-faire approach (Ferreri & Sanyal, 2018), leading to an unrefined expansion of the P2P accommodation sector. With these issues in focus, the thesis aims to contribute to the broader understanding and offer insights that urban managers might utilise to craft urban policies. Additionally, it intends to enrich the national policy debate concerning the embeddedness of short-term rentals within the housing system. The research extends beyond current understandings by augmenting the theoretical, conceptual, and methodological knowledge of the short-term rental market, which is presently at the forefront of scholarly exploration. This scholarly pursuit aspires to provide a comprehensive view of the sector's dynamics and its interplay with urban development and housing policies.

1.2 Research aim and objectives

Urban areas, being the hubs of tourism and commerce, are the regions with the highest concentration of P2P rental demand. The rapid proliferation of P2P accommodation platforms has put unprecedented pressure on the urban housing market (Shabrina, Arcaute, & Batty, 2021; Liang, Yeung, & Au, 2022). The UK government has recognised the substantial impact these platforms have had on both the guest accommodation sector and the broader housing system. In response, the DCMS (2023) launched a consultation on a registration scheme for short-term lets in England. This initiative aims to ensure the provision of safe and high-quality guest accommodation, assist local authorities in pinpointing the locations of short-term lets within their jurisdiction, and adequately equip local authorities to address the housing market effects arising from a plethora of short-term lets. However, prevailing uncertainties complicate the understanding of their spatial expansion and the consequent effects on neighbourhoods across the UK.

The aim of this thesis is to analyse the geography of P2P accommodation, considering its potential role in inducing gentrification and contributing to a deepening rent gap in three cities in England, specifically Greater London, Greater Manchester and Bristol. In doing so, it focuses on the spatio-temporal characteristics of P2P lodging prompted rent gaps and their association with housing affordability from 2016, urban gentrification. Simultaneously, the COVID-19 pandemic has presented an opportunity to explore how the P2P lodging responded to a globally disruptive event. This is undertaken drawing on publicly available geospatial and Airbnb listings data. The research objectives are as follows:

1. To undertake a critical review of existing literature and to establish a framework that aligns the rent gap with the advent and rapid expansion of P2P accommodation, reflecting its potential as a driver of urban gentrification. Underpinning this objective are the following questions:
    - How has the arrival of P2P accommodation been enabled as a new form of rentierism in the context of housing financialisation?
    - What are the theoretical and practical underpinnings of P2P accommodation induced rent gaps?

2. To explore the trends, spatial patterns and characteristics of Airbnb and the associated rent gap over time. This second research objective focuses on the following questions:
    - What are the trends for different types of P2P accommodation over time?
    - Where are the hot-spots of Airbnb growth?
    - Where are places more prone to the creation and agglomeration of the rent gap?
    - Which neighbourhood types are more critical for rent gap formation?

3. To link the professionalisation of P2P accommodation to problems of housing affordability and susceptibility to urban gentrification. The research questions guiding this objective are:

- In what ways does the proliferation of P2P accommodation in neighbourhoods potentially increase pressure on housing affordability?
- Does it exacerbate the socio-spatial inequalities of housing within the city region?
- To what extent does the penetration of P2P accommodation disrupt neighbourhoods and contribute to the potential for gentrification?

4. To investigate the response of the P2P accommodation market, with a focus on Airbnb, during the COVID-19 pandemic, and to determine whether the disruptor was disrupted. This objective addresses the following questions:

- What impact did the COVID-19 pandemic have on the supply of Airbnb properties?
- What strategies did Airbnb hosts adopt in response to the COVID-19 pandemic, and how effective were they?
- How did Airbnb rentals perform in terms of revenue generation across different phases of the pandemic and was performance affected by specific neighbourhood characteristics?

1.3 Research design and contribution to knowledge

Owing to the boom of P2P accommodation platforms in recent years, the impact of which is beginning to take many forms in the urban space, such as the redevelopment of decaying areas in the city, changes in the commercial fabric, the influx of tourists to communities and the displacements of tenants (Mihalic, 2020; Grisdale, 2021; Butler & Dodds, 2022; Cheung & Yiu, 2022). The multifaceted impacts of platform development have created certain social problems alongside significant economic benefits, and therefore merit discussion from the perspectives of different interest groups around P2P accommodation. As the development process of the P2P accommodation market varies from city to city and region to region, the degree and manifestation of P2P-accommodation-induced gentrification may also vary. Hence, overall, exploring the market impact, and spatial interactions of home sharing will help us to objectively confront the various impacts of P2P accommodation platforms and provide a basis for developing effective regulatory approaches. This study adds knowledge to the relatively limited literature by analysing the impact of P2P accommodation on the housing market from the following perspectives:

(1) The first contribution is to reveal the capitalising effects of P2P accommodation platforms in the context of the touristification and financialisation of housing. Major cities in the UK are experiencing financialisation of housing and professionalisation in the provision of P2P rentals,

where financial players adopt a range of strategies to profit from housing (Silver, 2018; Blakeley, 2021). P2P accommodation acts as an instrument that contributes to the financialisation of housing and introduces new capital flows (Cocola-Gant & Gago, 2019). By tracing the process of disruptive innovation brought about by the rapid capitalisation of P2P accommodation, this study can throw light on how the broader context of housing financialisation has promoted the emergence and development of P2P accommodation platforms, as well as how these platforms have in turn reinforced the salient features of housing financialisation and provide a unique insight into the trend towards financialisation.

(2) Secondly, this research will be a valuable contribution to the range of theoretical explanations for urban gentrification based on rent gap theory (Wachsmuth & Weisler, 2018). Taking the opening and closing of the rent gap as an entry point, this study, which compares three British cities with different degrees of advancement of home-sharing and a large number of travellers who use Airbnb, will outline the stages of change in the opening and closing of rent gap experienced in cities with different socio-economic backgrounds. By employing multiple high-quality micro-level datasets such as P2P rental prices, private rental prices, and the median house price to track subtle changes in the rent gap for neighbourhood units, these datasets enable the identification of clues as to whether Airbnb causes fluctuations in the private rented sector and to uncover the spatial characteristics of the rent gap and the mechanisms affecting housing affordability. Furthermore, it can disclose the patterns of the new form of gentrification led by home-sharing and provide empirical evidence of the dynamics of the housing market in the UK urban context.

(3) This thesis can also enhance the understanding of the association between P2P accommodation and housing affordability in internationalised and tourist-oriented cities. Gentrification of one place usually implies impoverishment of another (Fransham, 2020). Some existing residents face housing inequality caused by gentrification, which not only results in population displacement, but may also lead to the targeting of amenities and services to high-income earners (Helms, 2003), thus eroding the space of facilities for low-income earners and leading to the transformation of urban spatial structure. An exploration of the impact of the P2P accommodation development can be of value to both literature and policy practitioners: on the one hand, it can enrich the literature on the divergent effects of the sharing economy, deepening the understanding of the role of stakeholders, the state of urban inequality and the urban spatial structure; on the other hand, it can provide scientific guidance for making effective regulations on mediating the P2P accommodation platforms.

(4) Lastly, the study contributes to the deep understanding of the analytical exploration of the Airbnb market's response to the COVID-19 pandemic within Greater London. It achieves this by examining Airbnb listings, revenues, and their

spatio-temporal dimensions. By employing a geospatial framework, the study will pinpoint neighbourhoods that witnessed substantial shifts in Airbnb activity and revenue throughout the pandemic. Additionally, it will evaluate the key factors that have shaped the distribution of Airbnb listings throughout Greater London. Furthermore, the study will probe the potential relationship between Airbnb rental revenues and levels of neighbourhood deprivation, exploring any evidence of spatial clustering in Airbnb revenues across Greater London during the various phases of the pandemic. This assessment solidifies an empirical understanding of the Airbnb market's adaptability during a period of global uncertainty (Dolnicar & Zare, 2020; Shan, He, & Wan, 2023).

1.4 Structure of the thesis

Rather than focusing solely on the supply of affordable housing and local government mortgage tax policies, the housing crunch associated with home sharing can be seen as an extension of the possibilities for the financialisation of housing to capture extra value from the built environment.

In this **Chapter 1**, it briefs the development of the sharing economy, touristification, and platformisation, which constitute the research background of this thesis; it also introduces the main research aim, objectives, and contribution to knowledge from a general perspective, as well as the research design and the main content arrangement.

Chapter 2 engages with the debates around the sharing economy and its stimulation for touristification, as well as the evolution from platform economy to platform urbanism. It provides an overview of the UK housing system and the disputes that have surfaced from the emergence and development of P2P accommodation platforms. It will also offer insights into the theoretical interpretation for the overlap between P2P accommodation, housing systems, and neighbourhood gentrification, as well as the method of financialising housing through P2P platforms. This chapter aims to provide a comprehensive understanding of the complex interplay between these elements and their implications for urban development.

Chapter 3 establishes the conceptual framework and delineates the research methodology. It begins with developing a conceptual framework by incorporating P2P accommodation into rent gap theory, which is considered the means through which to guide the progress of the research. The chapter proceeds by justifying the selection of the study areas, providing a systematic and critical evaluation of their relevance to the research aims. It then articulates a comprehensive account of the data employed in this thesis, detailing their sources and processing techniques. The last part offers an overview of the research methodology adopted during the course of the research, and methods adopted for specific aspects of the research are expounded in detail.

Chapter 4 is dedicated to contextualising Airbnb in the city, giving a broad trend of the distribution of Airbnb listings. It also seeks to evaluate the regulatory measures on short-term rentals, examining various regulatory timelines from cities around the globe and drawing parallels between international contexts and the UK environment. Such a comparison is then consolidated into potential theoretical and strategic frameworks for urban governance.

Chapter 5 focuses on the space-time dynamics of Airbnb in major cities in the UK. It takes a close look at the temporal trends of Airbnb in different cities considering diverse listing types and derives their spatial growth patterns. Next, this chapter turns its attention to the opening and closing of the rent gap by measuring through a suite of indicators and dissecting the underlying causes. Lastly, the chapter investigates the characteristics of neighbourhoods that make rent gaps more frequent, which reveals why certain neighbourhoods are more susceptible to rent gaps.

Chapter 6 embarks on an in-depth investigation into the professionalised Airbnb property listings and their relationship with housing availability. With Airbnb listings and property transaction data, the chapter uses descriptive statistics, spatial analysis, and a repeat sales design to measure and compare the impact of Airbnb density in neighbourhoods with different property types and bedroom counts on housing prices. Rigorous statistical analyses provide us with preliminary evidence of the correlation between the presence of Airbnb and changes in property values.

Chapter 7 further delves into the heterogeneity of professional Airbnb's impacts, using a multilevel model that takes neighbourhood effects into account to scrutinise how they diverge across various neighbourhoods. In the latter part, the focus shifts to the potential impact of these Airbnb listings on neighbourhood churn. This includes an examination of the socio-economic consequences of properties that are occupied by Airbnb in the long-term, focusing specifically on the pressure of displacement they exert, with a particular emphasis on deprived neighbourhoods.

Chapter 8 delves into whether the disruptor – P2P accommodation – was disrupted during the COVID-19 crisis. It begins by providing a comprehensive understanding of the disruption of Airbnb revenue stream due to the pandemic. Subsequently, the chapter transitions into an exploration of the spatial patterns of Airbnb revenue during the pandemic from a neighbourhood-level perspective. The chapter then proceeds to uncover the variability in Airbnb rental revenues, revealing how they have been influenced by location, the quality and type of amenities offered, and the socioeconomic features of the host neighbourhoods. Further deepening the investigation, the chapter unpacks the spatial spillover effects on Airbnb revenue and how deprivation influences Airbnb performance.

Chapter 9 encapsulates the key findings and insights and begins by highlighting the merits and limitations of the research. It then presents the potential implications of this research and translates theoretical insights into practical recommendations. These proposals discuss the implications of these outcomes, which support policymaking and strategic decision-making, and serve as a guide for policies related to the disruption of the online platform economy. Finally, this chapter identifies promising avenues for future research directions.

The research roadmap in the Figure 1-1 shows the scheme that configures the research aim, the research content and the set of methods.

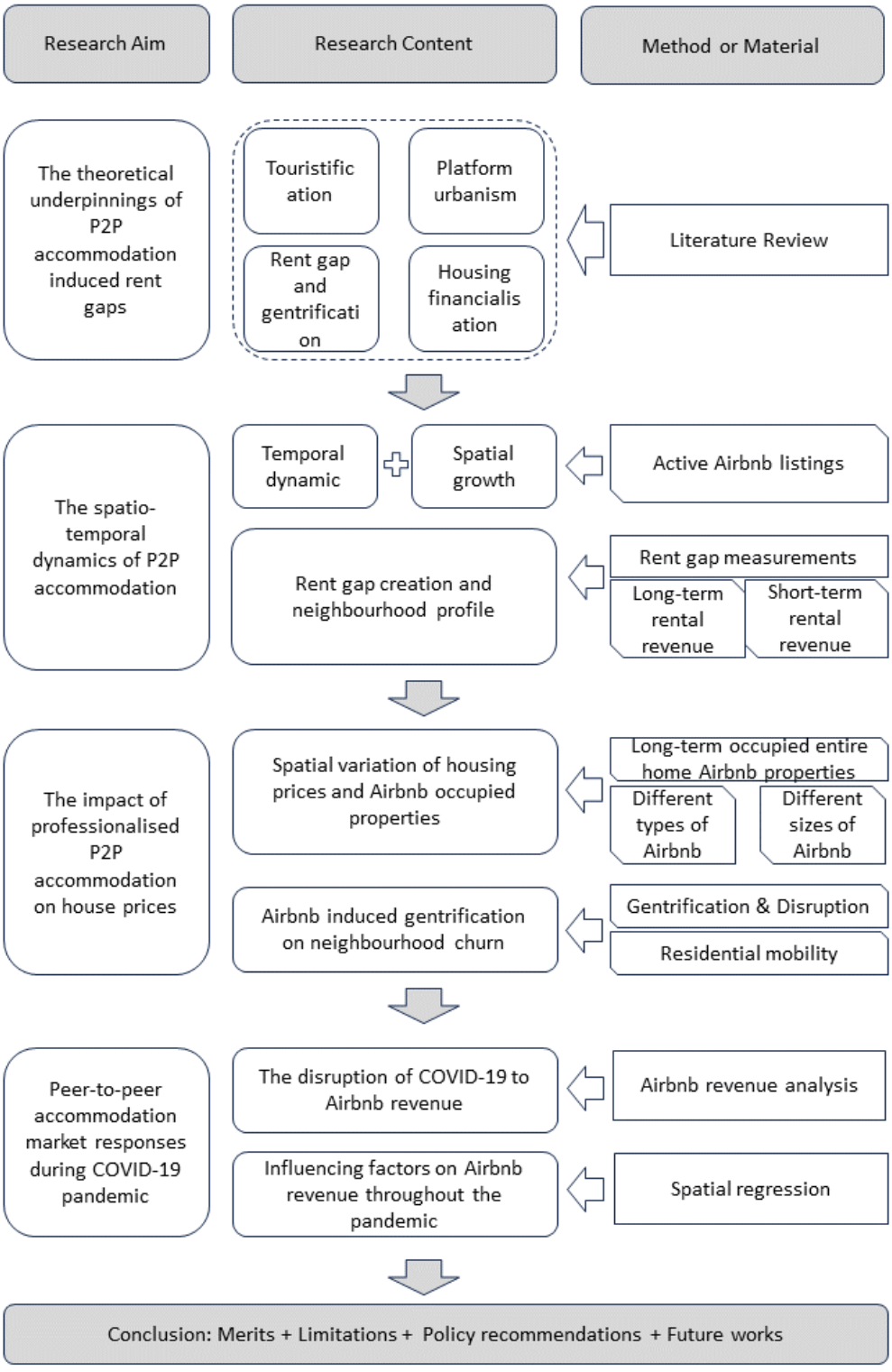


Figure 1-1 Research roadmap.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter endeavours to offer a theoretical background to the question under investigation. It will scrutinise the evolution of the sharing economy with a particular focus on its role in driving tourism development. First, the chapter will define the sharing economy and analyse its potential contribution to tourism development. Subsequently, the chapter will explore how P2P accommodation services can contribute to touristification. Subsequently, the chapter will discuss the concept of platform urbanism, including how platforms shape places, the transition from platform capitalism to platform urbanisation, and the significance of data in contemporary urban settings. This chapter draws on rent gap theory and its implications for gentrification to summarise how P2P accommodation affects housing affordability and disrupts residential areas. It then proceeds to the UK housing market, focusing on the scarcity of affordable housing and the financialisation of housing. In the last part of the chapter, exploration of the intersection between the housing financialisation and P2P accommodation reveals the process of professionalisation of the sector. The chapter critically analyses this process both in terms of its impact on economic welfare and the mechanisms by which professionalised P2P accommodation hosting facilitates the financialisation of housing.

2.2 The growth of the sharing economy: new terrain of touristification

For centuries, the tourism industry has blazed its own trail across destinations. However, these time-tested footprints are facing a shift. Propelled by P2P platforms and digital connectivity, the innovative sharing economy wave is not only reshaping the way we travel, but also redrawing the map of tourism, creating uncharted territory full of potential (Fang, Ye, & Law, 2016). Yet alongside these opportunities lurk shadows. Concerns about touristification, rising costs of living and cultural erosion loom like dark clouds as the tentacles of tourism reach into previously untouched corners (Neuts, Kourtit, & Nijkamp, 2021). This section outlines the sharing economy model and the challenges of touristification posed by its intrusion, particularly through P2P accommodation, into the tourism sector.

2.2.1 Sharing economy

The sharing economy emerged in the United States after the 2008 financial crisis as a new economic model, driven by factors including declining household incomes, increasing integration of technology in daily life, and growing demand for sustainable lifestyles (Kathan, Matzler, & Veider, 2016). Prior to this, there were only a few platforms such as Craigslist, operated as classified advertisement websites, and some non-profit organisations facilitated local item-gifting schemes (Fremstad, 2017). The sharing economy reflects a growing awareness of the holding costs of ownership and the inefficiencies inherent in the use of assets like automobiles and real estate (Stephany, 2015). More and more owners are increasingly seeking not the products themselves but rather the benefits they offer. This shift optimises the use of underutilised resources and enhances the efficiency of supply and demand on platforms. From its initial focus on transportation and accommodation, it has branched into diverse commercial domains, including peer-to-peer lending, crowdfunding, freelancing, workspace sharing, etc (Dredge & Gyimóthy, 2015). This type of sharing is referred to as the 'sharing economy' or 'collaborative economy' and its expansion reflects its adaptability and broad appeal.

The dynamics of the sharing economy diverge markedly from traditional commercial prototype. It fosters interactions amongst strangers, extending beyond conventional, geographically-bound communities (Richardson, 2015; Cheng, Mou, & Yan, 2021). All the exchanges are structured within a prescribed framework and transactions are facilitated by digital platforms. These P2P platforms allow individuals to collaborate on using idle inventory while sharing costs. In other words, the sharing economy model embraces characteristics of crowdsourcing and crowdfunding to develop new attractions and services (Chandna, 2022), enabling the process of value co-creation between local people, tourists, and other stakeholders. This leads to innovations and experiences that are more relevant and tailored to specific people or communities.

In essence, the sharing economy represents a significant shift in consumer behaviour and business models, driven by technological advancements and changing perceptions of ownership and collaboration. It embodies a more efficient, community-focused, and sustainable approach to resource utilisation, resonating with contemporary socio-economic priorities.

2.2.2 Tourism fuelled by the sharing economy

An increasing number of individuals are opting to temporarily share their possessions (e.g., their house or car) or their activities (e.g., for example meals or excursions) with tourists (Gansky, 2010; Barns, 2019). This trend is not exclusive to the tourism sector and can be observed across various domains of social and economic activity. However, it is noteworthy that tourism is among the sectors that have been most significantly influenced by this shift (Gössling & Hall, 2019).

Within the travel and tourism industry, this collaborative consumption of space and assets has brought about a disruptive force. A host of stakeholders, including local residents, tourists, traditional suppliers, platform providers, and policy makers, are found collaborating to co-create unique tourist experiences (Hati et al., 2021; Sigala, 2022). In doing so, they are collectively reimagining and reshaping the values, motivations, purposes, and methods of travelling and experiencing tourism (Reuschl et al., 2022). Consequently, the sharing economy has introduced a dynamic era where collaboration and shared resources redefine the very essence of the travel experience, marking a significant departure from past practices.

It is within this ideological space that the sharing economy has gained momentum in the tourist industry (Dredge & Gyimóthy, 2015). From the consumer's perspective, the sharing economy covers a range of in tourism related sectors (Dredge & Gyimóthy, 2015; Kooti et al., 2017; Lin et al., 2020; von Zumbusch & Lalicic, 2020; Melián-González, Bulchand-Gidumal, & Cabrera, 2022; Pung, Del Chiappa, & Sini, 2022): (1) Accommodation: homestays and short-term rentals, co-living spaces; (2) Transportation: ride-sharing services, car-sharing; (3) Experiences and Activities: activity sharing platforms, equipment sharing; (4) Food and Dining: meal sharing, food delivery; (5) P2P Services: tourist guide services, language exchange; (6) Resource Sharing: bike and scooter rentals, space sharing (e.g., co-working spaces and shared workspaces). These applications have had profound implications for the tourism industry, impacting the way accommodation is sourced, transportation is facilitated, experiences are curated, dining is approached, P2P interactions occur, and resources are shared within the travel ecosystem (Reuschl et al., 2022). This creates a dynamic and interactive landscape where tourism marketing is not only a tool for reaching and satisfying existing customers, but also a process of co-creating and influencing tourism markets and actors using technology.

This new economic paradigm has far-reaching implications on various fronts, which can be categorised into three main areas:

(1) Economic impact. *Increased access and affordability*, P2P platforms promote affordable global services and make it easier for individuals to provide products and services, but it does not guarantee the quality (Martin, 2016); *Enhanced income and choice*, interest in non-popular tourist areas drives income growth in local communities, while the sharing economy offers consumers a wider choice of goods, opportunities for personal development and flexible working hours (Gil & Sequera, 2020); *Reduced costs and improved efficiency*, tourism service providers can respond better to peaks and troughs in demand and travellers can compare prices, access information, view opinions and communicate directly with service providers (Valentinas et al., 2021); Lack *fiscal regulation*, there will be

unfair competition, tax avoidance, and more risks and uncertainties for workers and consumers (Martin, 2016).

(2) Environmental impact. *Resource sharing and product life cycles,* the sharing economy can save water and energy, reduce greenhouse gas emissions, and extend the lifespan of products, however, affordable price to tourists can lead to additional tourism consumption (Meshulam et al., 2023); *Destination diversification and congestion relief,* The sharing economy can help to distribute the tourist flow to less popular areas and reduce the pressure on overcrowded destinations (Mody, Hanks, & Cheng, 2021). *Facility optimization and land use efficiency,* the sharing economy can optimise the use of existing facilities and reduce the need for new construction or expansion (Bakker & Twining-Ward, 2018). This lowers the environmental impact of tourism development and improves land use efficiency.

(3) Community impact. *Promoting community spirit*, The sharing economy promotes a sense of community spirit by enabling local citizens to share their resources and experiences with tourists; *Social inclusion and mobility*, the sharing economy allows people from different backgrounds to participate in the tourism sector which increase social inclusion and mobility, but it may also reduce the altruistic sharing, as people may prefer to monetize their unused assets (Huang & Kuo, 2020); *Authentic and immersive travel experience*, unlike traditional tourism, the sharing economy allows tourists to have more authentic and immersive experiences (Liang, Choi, & Joppe, 2018); *Algorithmic discrimination,* the sharing economy relies on customer ratings and reviews, which may be biassed by gender, ethnicity, race, or other factors (Cheng & Foley, 2018).

The sharing economy has brought many benefits to both tourists and hosts, such as lower costs, greater choice, income generation, and authentic experiences. However, it has also posed some challenges and risks for the tourism industry and the local communities. Nonetheless, the benefits of the sharing economy outweigh the drawbacks in most cases, and as a result, it has boosted touristification in some places.

2.2.3 P2P accommodation serves for touristification

In the context of tourism, shaped by the sharing economy, issues of 'touristification' have emerged as both a beneficiary and a byproduct (Neuts, Kourtit, & Nijkamp, 2021). This term captures the transformation of spaces and local cultures as they adapt to, and are consumed by, tourism (Cheung & Yiu, 2022). The sharing economy, particularly in the domain of accommodation, has played a pivotal role in this transformation.

Central to this discourse is the role of accommodation in the travel experience. Unlike the transient nature of transport or the episodic consumption of food, accommodation forms the crux of a traveller's journey, offering a temporary yet intimate connection with the destination. P2P accommodation platforms like

Airbnb have not only introduced diversity in lodging options but have also enriched the essence of travel and tourism. This change is not limited to the type of accommodation available; it extends to how travellers interact with their destination and its community (Prayag & Ozanne, 2018).

One of the main ways that P2P accommodation contributes to touristification is by increasing the supply of tourist accommodation (Adamiak, 2022). By offering cheaper and more diverse options than traditional providers, the sharing economy platforms enable more people to travel and stay longer in a destination. For example, Airbnb claims that its guests spend more time and money in the local economy than hotel guests (Li & Srinivasan, 2019; Shabrina, Buyuklieva, & Ng, 2020). However, this also means that more residential spaces are converted into tourist spaces, reducing the availability and affordability of housing for locals (Liang, Yeung, & Au, 2022). Airbnb has contributed to the rise of rents and house prices in several cities, such as New York (Sheppard & Udell, 2016), Miami (Li, Kim, & Srinivasan, 2022) and London (Shabrina, Arcaute, & Batty, 2021). Furthermore, a considerable rise in tourist arrivals in a neighbourhood may prompt services, facilities, and shops to be reoriented towards the tourists' preferences rather than those of local residents (Cheung & Yiu, 2022). This means that areas with more Airbnb listings bringing in visitors tend to have more tourism-related amenities and can simultaneously accelerate neighbourhood touristification (Neuts, Kourtit, & Nijkamp, 2021). This trend, in turn, facilitates the transformation of a community into a tourism commodity. On top of that, the influx of tourists can create conflicts and tensions with the local residents, who may feel displaced or disturbed by the noise, traffic, and pollution generated by the visitors (Gurran & Phibbs, 2017).

Another way that P2P accommodation contributes to touristification is by changing the patterns and preferences of tourist behaviour. By allowing tourists to access local resources and experiences, the P2P platforms can transform residential areas into tourist destinations, attracting visitors who seek a more authentic and immersive travel style (Liang, Choi, & Joppe, 2018), as well as a more responsible tourism. Airbnb guests tend to visit less popular areas and attractions, and to interact more with the local culture and people (Mahadevan, 2022). However, this can also have some drawbacks, such as the commodification and homogenization of local culture (Törnberg, 2022a), the invasion of privacy and intimacy (Roelofsen & Minca, 2018), and the creation of new forms of inequality and exclusion (Cheng & Foley, 2018). Should tourists begin to irritate local residents, this could lead to a net negative externality (Cheung & Li, 2019), including potential displacement. The sharing economy can reinforce the power and privilege of certain groups, while marginalising others, based on factors such as race, gender, class, or disability (Attri & Bapuji, 2021).

2.3 Platform urbanism

It is widely recognised that societal transformations—encompassing technology, institutions, economics, and culture—inevitably have spatial implications (Leszczynski, 2019). Cities, due to their dense population, serve as the primary catalysts for these changes (Zukin, 2020). They encapsulate mature markets that offer a diverse array of goods and services. As such, cities provide the spatial arena where platform enterprises – participants in digital platform markets and commercial entities – can capitalise on the spatial proximity of potential consumers, producers, workers, and interconnected devices (Acs et al., 2021). As P2P platform companies increasingly see cities as strategic places to secure and expand market share, and as cities around the world simultaneously position themselves as experimental spaces for new digital platforms and technological capital (Leszczynski & Kong, 2022), P2P platforms are understood becoming a new urban institution, where the original post-welfare society of the relationship between market, state and civil society actors is eroding (Bissell, 2020; van Doorn, 2020). This platform urbanism goes far beyond the simple digitisation of urban services but reshapes the reproduction of urban spatial resources, capital and data flows (Boeing et al., 2021; Söderström & Mermet, 2020).

2.3.1 Platform placemaking

"Platform placemaking", a term introduced by Törnberg (2022a), describes how P2P platforms mobilise their users to shape spatial imaginaries in the interests of the platform. First of all, a profound issue with it would be the social reproduction of space. According to how these platforms interact with existing infrastructures, new demand for urban space is mobilised at scales that explode the existing space (Stehlin, Hodson, & McMeekin, 2020). For example, P2P accommodation platforms tend to focus on markets with the highest demand from mobile populations, and the populations they serve in broader areas have a significant impact on the daily life of these neighbourhoods in the CBD, surrounding upscale areas, and tourist attractions (Eugenio-Martin, Cazorla-Artiles, & González-Martel, 2019; Yang & Mao, 2020; Jiang et al., 2022). This can lead to a reconfiguration of urban spatial resources as homes, apartments, and even entire neighbourhoods can be expanded beyond the confines of traditional arrangements and repurposed for short-term rentals. This process also involves using reviews and descriptions to reshape urban places (Söderström & Mermet, 2020). Such changes disrupt the rhythm of local life, altering the local sense of place, the retail mix, and the demographic character of the neighbourhoods. As a result, the material production of cities has undergone significant changes, blurring the borders between housing and tourist accommodation (Stabrowski, 2017; Söderström & Mermet, 2020), which transcends mere economic advantages and obstacles to reshape the very structure of urban spaces.

This phenomenon of platform urbanism has given rise to what some call a “techno-capitalist takeover of cities” (Sadowski & Gregory, 2017). Platforms assert an overarching influence on every facet of urban existence, brokering access to other services and/or assets as a basis for monetization. This influence extends beyond the digital realm, impacting physical spaces and infrastructure in cities.

2.3.2 From platform capitalism to platform urbanism

The notion of platform urbanism represents an extension of the concept of platform capitalism. Rodgers & Moore (2018) added nuance to the idea by speculatively substituting "capitalism" with "urbanism". The discourse around this concept has been expanded upon by Sadowski and Gregory (2017), who articulated the influence of platforms on urban spaces as a manifestation of unbridled capitalism. It’s a new form of capitalism that is marked by speculative capitalisation and monopolistic tendencies.

In this sense, platform urbanism is underpinned by speculative capitalisation. Investors pour substantial capital into fledgling platforms, particularly P2P accommodation services, in anticipation of future profits (Stehlin, Hodson, & McMeekin, 2020). These platforms operate in an asset-light way, expanding their user base and monopolising the data generated to attract further investment. This speculative interest is due to the potential of the platform to monopolise rents (Fields, Bissell, & Macrorie, 2020), demonstrating the structure of a venture capital fund. Platforms attract investment by demonstrating their potential to generate significant returns. However, the risks and initial costs of this strategy are high, and the subsequent investment in the operation is distributed, allowing each participating user to become a small capitalist.

2.3.3 Valuing data in the city

Platform urbanism is perhaps the most potent expression of the power of data in cities (Söderström & Mermet, 2020), with these platforms representing new forms of urban governance that blend technological innovation, data drive and effectiveness orientation (Lee et al., 2020). Platform urbanism is seen as representing a paradigm shift in how cities are managed and governed. This paradigm is underpinned by the commodification of personal data by platforms for a myriad of purposes (Thatcher, 2017), including service customisation, advertising, and urban governance.

At the heart of platform urbanism is the concept of data commodification. Personal data, colloquially referred to as 'data sweat' (Gregg, 2015), is increasingly being viewed as a valuable commodity (Rose et al., 2021). Platforms harvest this data to tailor their services and make strategic decisions, thus shaping user experiences and influencing behavioural patterns. Airbnb seeks to harness its valuable data holdings and 'host community' through the visionary use of its own

model of platform urbanism (Söderström & Mermet, 2020), which Airbnb has positioned as a collective of start-up individual households seeking supplementary income in a context of economic insecurity (van Doorn, 2020) and opportunities presented by technology.

Beyond service customisation and strategic decision-making, platforms are also emerging as new forms of urban governance. They influence urban planning and resource allocation, often in real-time, leveraging the vast amounts of data at their disposal. In this socio-technical imagination of a 'real-time city' (Kitchin, 2014), data serves as a critical diagnostic tool for monitoring urban behaviours, optimising resources, and improving city efficiency. Barns (2019) describes them as 'platform fulcrums', as platforms become organisations within societies that are the focus of socio-technical and political-economic models. The platform is not just a technical entity, it represents a unique socio-technical imaginary for the articulation of urban space, which has a significant impact on urban planning (Leszczynski, 2019).

However, the role of data in platform urbanism is not without controversy. Criticism arises from what is termed as 'data colonialism' (Thatcher, O'Sullivan, & Mahmoudi, 2016) — an asymmetric power relationship where individuals' data is exploited for corporate profit. This data dispossession often occurs without the explicit consent of individuals, leading to concerns about privacy, autonomy, and economic insecurity.

Thus, platform urbanism represents a new frontier in urban governance, one that is characterised by data commodification, real-time city management, and an increasing reliance on platforms, but the rise of this paradigm also brings to the fore concerns over data colonialism and the potential for exploitation.

2.4 Rent gap theory and gentrification

The narrative surrounding the sharing economy, exemplified by P2P platforms like Airbnb, has highlighted its profound influence on urban landscapes, particularly in terms of touristification and platform urbanism. Touristification involves the commodification of local character and cultural assets, while platform urbanism underscores how digital platforms are instrumental in reshaping urban spaces and interactions. These dynamics, often come at the cost of local communities, inadvertently fuel gentrification, as in-movers with higher spending power disrupts the existing equilibrium and distorts the natural value of land (Sequera & Nofre, 2020). This is therefore tied into broader issues such as the rent gap and gentrification.

2.4.1 The rise of tourism gentrification research

2.4.1.1 The inception of gentrification studies

In 1964, Ruth Glass first coined the term "gentrification" to describe the phenomenon of middle-class intrusion into working-class neighbourhoods in inner-city London (Glass, 2010). Since then, scholars from various disciplines have studied and written about this process. For example, they have debated whether the return of population or capital to city centres drives gentrification and whether the economic revitalisation typically brought about by gentrification outweighs the human cost of displacing long-term residents (Guinand, 2017). Over more than half a century, the connotation of gentrification has continuously expanded. Gentrification research has entered a stage of integration with economic redevelopment and new cultural strategies, evolving to a spatial restructuring process in different regions (Aalbers, 2019).

During this period, Smith's rent-gap theory provided an explanation for the causes of gentrification from the production side (Redfern, 1997), which subsequently sparked a prolonged debate between the production-side and consumption-side perspectives on gentrification. The production-side focuses on changes in production methods and economic structures. Neil Smith, from a neo-Marxist analytical standpoint, interpreted the gentrification process from a political-economic perspective and has been the leading proponent of the economic determinism for the causes of gentrification (Albet & Benach, 2017). He argued that the transformation of urban industrial structures and the deindustrialisation of city centres are the fundamental conditions that make reinvestment in inner-city housing profitable (Smith, 1982). Hackworth (2001) has expanded on Smith's work, examining how gentrification has evolved over time and argues that gentrification in its current form is more corporate-driven and state-facilitated than in earlier periods.

From the perspective of consumption, more attention is paid to the culture and social changes, focusing on the personal preferences and consumption needs, as well as cultural demands of the middle class (Gotham, 2005). An important analysis in this traditional perspective comes from Ley (1980, 1986), who deeply explored gentrification in six Canadian cities and emphasised that gentrification cannot be explained by only considering the supply side without analysing consumer preferences, as there must be a group of affluent buyers to consume the expensive housing in renovated traditional working-class neighbourhoods for gentrification to occur. Therefore, gentrification should be more associated with the personal consumption tastes and local social culture of the middle class (Ley, 1997), that is, gentrification is a consumption "cultural movement" (Ley, 1986), rather than being production-led.

Since then, gentrification is no longer a simple process of residential space succession but has extended to the fields of cultural and commercial spaces. Gentrification also appears in tourist areas, where gentrifiers renovate the functions and appearance of residences according to their preferences, leading to

the emergence of entertainment and leisure industries that serves tourism. This transformation of community class and function is a reproduction of the local spaces, forming unique characteristics of tourism gentrification.

2.4.1.2 The development of tourism gentrification

Tourism gentrification specifically refers to the phenomenon of gentrification caused by the impact of tourism on urban and non-urban spaces. Certain areas undergoing redevelopment or construction through the tourism development and entertainment projects has resulted in these areas and their surrounding communities turning into exclusive neighbourhoods (Guinand, 2017). This phenomenon is closely related to urban renewal and is usually accompanied by increased land use pressure due to tourist attraction, rising values of local commercial and residential properties, and the displacement of existing populations or community residents (Cocola-Gant, 2018). This form of middle-class transformation occurs worldwide, including in coastal (Gutiérrez & Domènech, 2020) and rural areas (Lorenzen, 2021).

Tourism gentrification is also driven not only by economic investment and market forces but also by consumer behaviour and preferences. From the production side, the process of tourism gentrification is always accompanied by capital reinvestment and improvements to the built environment (Sequera & Nofre, 2020), resulting from the inherent logic of capitalist market operations. On this basis, factors such as capital, policy, real estate development and technology have all played a part in contributing to the creation of tourism gentrification (Cocola-Gant, 2018). Once the destination infrastructure is in place, local branding and marketing to attract tourists takes place, commodifying local culture, history and environment into a tourism product that can be sold to tourists.

As research on tourism gentrification deepens, some scholars view it from the perspective of national territory, suggesting that tourism gentrification results from national institutional supply (Sigler & Wachsmuth, 2020). The state strengthens territorial control and undertakes reconstruction costs by changing land use and reclaiming land jurisdiction, aiming to develop resources and economic construction at the national level, thus providing institutional guarantees for the development of tourism gentrification (Kan, 2020; Estevens et al., 2023). Real estate developers also play a crucial role in tourism gentrification; their decisions and actions directly impact the reshaping of regional tourism and leisure environments (Liang & Bao, 2015). The development of large-scale tourism and leisure projects often accompanies capital inflows and changes in regional economic structures, which may alter the original community structure and even lead to the displacement of low-income residents.

From the consumption side, tourism is a product of the combination of the history, culture, customs, and economic development of different regions. It is an

industry characterised by "the spatial fixity of grassroots cultural production and tourism commodities and local consumption (Gotham, 2005)." The history and cultural capital of the community are repackaged for global consumption, and the local identity and symbolic significance of the city are reconstructed by capital (Hayes & Zaban, 2020). For urban areas, the emergence of tourism gentrification stems from the changing leisure needs and preferences of the middle class. It relies on special leisure activities and places, unique urban environments and spaces, including living habits, consumption and cultural activities, nightlife, shopping, and service needs, to attract tourists. The preferences of the group bring new social and economic value to urban areas (Sigler & Wachsmuth, 2020), thereby achieving a transformation of spatial consumption. From the perspective of social class, the evolution of urban landscapes is to meet the creative class's desire for cultural diversity and authenticity (Florida, 2003). The rise of high-end tourism businesses in cities, such as boutique shops, starred restaurants, galleries, and museums, actively responds to the postmodern consumption needs of the new urban middle class (Lorenzen, 2021). The middle class's demand for authenticity and symbolic value leads to the "displacement" of traditional commerce, residence, or industry by the tourism and leisure industry in cities (Brown-Saracino, 2017). The countryside, with its unique landscape, green open spaces, tranquil life, and reasonable living costs, has also become an important area for the emergence of tourism gentrification (Alonso González, 2017; Gocer et al., 2021).

Since the 2010s, influenced by comparative urbanism, Lees proposed the concept of "the geography of gentrification", emphasising the three dimensions of geographical context, scale, and temporality in gentrification research (Lees, 2012). Currently, tourism gentrification has become a global phenomenon (Kan, 2021), and the introduction of the concept of planetary gentrification has officially initiated a scale shift in gentrification issues (Hayes & Zaban, 2020). This shift extends beyond Western global cities or metropolitans, and spreads to rural areas. A series of studies using new comparative urbanism and post-colonialism to explore global gentrification focus on the indigenous issues of tourism gentrification in different contexts, emphasising the de-Eurocentrism and localisation of gentrification theory (Waley, 2016), which has become an important reference for current global comparative research on tourism gentrification。

The application of a comparative research approach to gentrification in tourism avoids the stereotyped interpretation of the causes of tourism gentrification (production/consumption). Instead, it focuses on the mechanisms of capital dispossession, spatial repair, and uneven development reflected in tourism gentrification at different spatial scales, national and local contexts (Janoschka, Sequera, & Salinas, 2014; Aalbers, 2019; Zhang et al., 2022). It delves into important aspects such as the production-consumption integration, global-local interaction processes, modes of gentrification occurrence, and the impact of race/gender. This

leads to more significant and open topics, including the roles of the state and government, public-private partnerships, tourism social equity, degrowth discourse in tourism, and resistance movements against gentrification (Fox Gotham, 2018; Cocola-Gant, 2018; González-Pérez, 2020).

2.4.2 Rent gap theory

In the late twentieth century, neo-Marxist scholars articulated a spatial turn in the study and placed emphasis on social relationships represented in spatial production. Based on the differential land rent, Smith (1979) proposed the rent gap theory (Figure 2-1), which explains the occurrence of gentrification in the city from the economic perspective of capital appreciation and unravels the dynamics and mechanisms of capital investment in urban space by taking the role of producers into account. Smith argues that "middle-class gentrification is a product of the uneven development of cities between suburban and urban areas and is rooted in the profit-seeking nature of capital". In other words, there is a rent gap between the low housing value and the potential land value in the decaying urban centres. That is, the inner logic of the 1960s movement to return to the city was capital rather than people (Smith, 1979).

Here the rent gap is the difference between the potential ground rent and the actual ground rent; the potential ground rent is the ground rent with the highest and best land use, and the actual ground rent is the land rent capitalised under the current constraints (Hammel, 1999b). When a site is first up for bid, the competition between the various players ensures that the economic benefits of the site are maximised, at which point the potential ground rent equals the actual ground rent (Clark, 1995). Thereafter, the potential ground rent continues to grow due to positive externalities such as investment in urban infrastructure, improvement of built environment and technology spillover (López-Morales et al., 2019). On the other hand, capital solidified in space cannot be transferred in the short term, and buildings need maintenance due to depreciation, etc., resulting in decreasing actual ground rent (Diappi & Bolchi, 2008). As the rent gap gradually increases to the point where developers can earn substantial profits after paying for the selling price of the house, construction costs, and loan interest, capital will flow back to older urban areas and drive the gentrification phenomenon. This is consistent with the life cycle of residential properties (O'Sullivan, 2002).

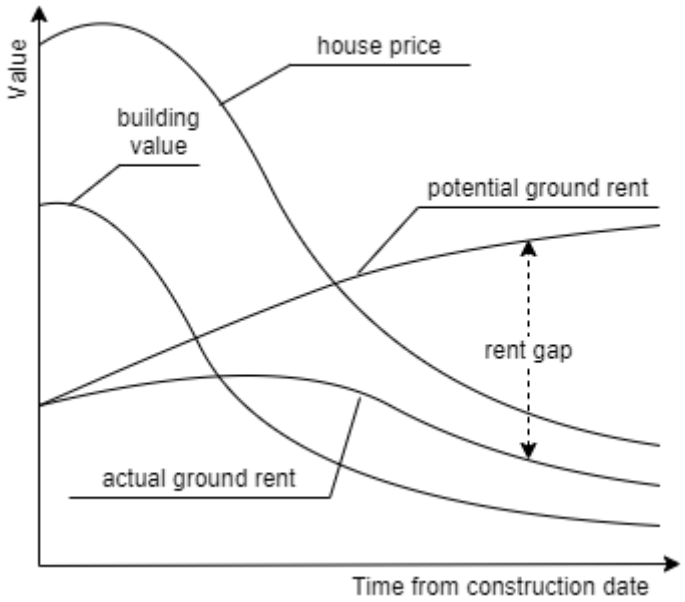


Figure 2-1 Changes in the rent gap in an inner-city neighbourhood (based on: Smith, 1979).

After the rent gap theory was proposed, it sparked extensive debate. Some either pointed out the shortfalls of the theory or even rejected the theory itself, or proposed ways to revise it. The rent gap theory has been criticised by post-industrial scholars such as Ley (1994) and Butler (1997) because of its emphasis on capital dominance and lack of attention to "people". Bourassa (1993) raised questions from the perspective of neoclassical economics, noting that Smith's distinction between two forms of land rent (capitalised and potential) did not help to explain the location and timing of land use change and did little to explain fundamentally why it has suddenly become apparent that there is a lucrative rent gap for potential gentrifiers. Others noted (Clark, 1995; Hammel, 1999a, 1999b; Lopez-Morales, 2011) the explanatory scope of the initial rent gap theory proposing ways to refine and supplement it, with misconceptions being addressed. Smith tends to apply the rent gap theory in declining and revitalising areas. However, as housing-sharing activities around the world have grown to the point of gentrification, some scholars have also applied the rent gap theory to explain this emerging phenomenon. Wachsmuth (2018) calls it a new form of rent gap in culturally desirable and internationally recognised communities. Yrigoy (2019) takes the same approach and finds that a similar rent gap arises in the highly touristic environment of Mallorca, Spain. Once the demand for short-term rentals from inbound tourists opened up a notable rent gap, a growing number of private actors stepped into the housing and P2P rental market and professionalised their investments and operations in the area. The supply of housing is gradually coming under the control of professional actors in the P2P accommodation business, resulting in a significant shift in housing use. Together these studies provide

important evidence that P2P rentals serve as a tool to expand the so-called "urban tourism bubble" (Ioannides, Röslmaier, & van der Zee, 2019), opening up the rent gap between the P2P and private rental markets and, as a result, reducing the available residential stock for private rental, ultimately displacing residents (Amore, Bernardi, & Arvanitis, 2020).

2.4.2.1 Capitalisation and land value estimation

The formation of rent gap largely depends on the capitalisation of the willingness to pay for amenities and it is indicated by the house value. The capitalisation effects of attractions, environment, and transportation on residential markets have drawn academic attention. Oates (1969) first noted that population mobility capitalises taxes and public goods into house prices, thus initiating a series of empirical studies on the capitalisation effects of local public goods. The hedonic price theory proposed by Rosen (1974) has taken root as the theoretical basis for identifying the capitalisation effects of various liveability characteristics, including local public goods. The hedonic price model decomposes prices in three main aspects: structural, locational and neighbourhood characteristics (Watkins, 2001). It has also served as a common empirical method for analysing spatial differences or gradients in land values at the city level and within cities. As mentioned earlier, Smith's theory of the rent gap is based on dividing the value of land into two components: actual ground rent and the value of housing. The hedonic price theory, while not perfectly compatible with rent gap theory, can be extended in regard to estimating the actual ground rent (Liu, O'Sullivan, & Perry, 2018). Porter (2010) calibrated a hedonic pricing model that largely supports Smith's hypothesis by examining the change in the land value gradient in New York from 1990 to 2006.

On the other hand, P2P accommodation could potentially escalate or diminish a neighbourhood's potential ground rent, which will reflect the preferences of outsiders regarding their short-term residential location choices (Cheung & Yiu, 2022). The situation could further be beneficial if the process of touristification enhances a neighbourhood's appeal and attracts superior amenities (Cheung & Yiu, 2022). These net positive externalities harness a local community's assets, aspirations, and intentions (Dredge & Jenkins, 2003), and ultimately capitalise economic potential through successful development and short-term leasing of the property.

2.4.3 P2P accommodation and housing affordability

P2P platforms enter the real estate market, leading to fierce competition for housing stock. The increasing value of rental property on these P2P platforms have spurred homeowners into action, leading them to slope toward these platforms. Wachsmuth and Weisler (2018) show that in New York, the number of active

listings increased 4.5% from 64,200 in 2016 to 67,100 in 2017, even as a large number of listings were illegally converted from private rentals or hotels to P2P rentals. Shabrina et al. (2021) believes that private rental price changes stem from the possible misuse of Airbnb properties, with a doubling of the density of misused Airbnb potentially leading to an 8% increase in weekly rent per bedroom. Related studies from different regions (Quattrone et al., 2018; Lima, 2019; Aguilera, Artioli, & Colomb, 2019; Garcia-López et al., 2020) have also pointed to the fact that local listings are flowing from the housing or rental markets to P2P rental platforms.

In New York City, San Francisco, Los Angeles, and Boston, where the majority of residents are renters, rising rents and low vacancy rates have created an affordability crisis. A lot of studies show a positive correlation between an increase in Airbnb listings in a given area and an increase in asking rents for long-term rentals. Horn et al. (2017) found that every standard deviation increase in the density of Airbnb listings in Boston, USA results in 0.4% rise in asking rents. In New York City, 0.68% of the housing units were likely reallocated to Airbnb, resulting in an equilibrium price increase of 0.71% for long-term rentals, which led to overall welfare loss for renters (Calder-Wang, 2019).

As the housing market has a weak supply elasticity in the short term due to limited urban land resources, high development costs, and long housing construction cycles, it may be difficult for the urban housing market to absorb the shock from Airbnb without causing price fluctuation in a short span of time (Barron, Kung, & Proserpio, 2020). The specific impact of the P2P rental platform on local house prices has attracted considerable attention. As estimated by Sheppard's (2016) hedonic model, a doubling of the number of Airbnb listings leads to a 6 to 11% increase in house values. Similarly, Barron et al. (2020) found broadly consistent findings using data from across the US that a 1% increase in the number of Airbnb listings in the neighbourhood leads to a 0.026% increase in house prices, and the impact is stronger in areas with fewer owner-occupiers, as non-owner-occupiers are more likely to convert their properties to short-term rentals.

However, this effect gradually shows variation as the number of empirical cases increases. Coyle et al. (2016) found no significant correlation in a subsample from Germany, but a positive and statistically significant relationship between Airbnb activity and rental prices in the UK, where an average 1 percentage point increase in the number of Airbnb activities was associated with a 0.22 increase in the rental index. Levendis et al. (2016) could not find any scientifically valid evidence that New Orleans rent prices and the presence of Airbnb are correlated after controlling for regional rent changes, and concluded that Airbnb has no significant effect on rents in any New Orleans zip code. Garcia et al. (2020) noted that Airbnb activity prior to 2013 did not significantly affect rents and prices, with growth showing up from 2014 onwards. Additionally, the occupancy rate does not lead to higher rents in cities other than Lyon, Montpellier, and Paris (Ayouba et al.,

2020). Li and Biljecki (2019) found inconsistent findings in different neighbourhoods, while a study from Beijing even found that Airbnb exists to cause a decrease in house prices. Namely, the impact of P2P accommodation platforms on housing prices may vary across cities and even across areas within the same city.

The high revenue and flexibility of P2P accommodation platforms will inevitably lead to a shift from private to P2P rentals making a decreasing number of listings in the housing market. If the revenue from the P2P rental platform is not significantly higher than that of the private rental market, the loss of properties will be negligible. Therefore, whether or not further price fluctuations will occur may depend on the link between the number of properties shifted in use and the carrying capacity of the local housing market. In addition, studies (Griffiths, Perera, & Albinsson, 2019; Horton, 2015) also suggest that the frequent turnover of P2P rentals may also have an unwanted impact on the surrounding environment, thereby reducing the potential for price appreciation in the neighbourhood, but little data could be found to suggest that these negative externalities are highly correlated with P2P rentals, which would be a point of concern.

2.4.4 Residential gentrification and community disruption

Despite the seemingly unrelated link between P2P accommodation and neighbourhood gentrification, there is growing evidence that P2P accommodation is playing a subtle role in undermining residential communities (Spirou, 2011; Biagi, Brandano, & Lambiri, 2015; Lee, 2016).

P2P accommodation, unlike the tourism development typically seen in urban front stages, does not necessitate a significant surge in public service and infrastructure demand for its evolution (Yeager, Boley, & Goetcheus, 2020). Rather, it tends to exert its influence subtly from the community's backstage. Wegman and Jiao (2017) have posited that the high penetration rate of P2P accommodation profoundly impacts local communities, particularly affecting the quality of life. Once the concentration of P2P accommodation surpasses certain threshold in the geography, it often leads to increased foot traffic in residential areas. The arrival of transient visitors can significantly alter the social fabric of neighbourhoods (Prayag & Ozanne, 2018). Residential streets, once dominated by the daily life of residents, become overridden by tourist traffic. This shift necessitates additional vehicles within the neighbourhood, potentially leading to parking congestion (Cheng, Mackenzie, & Degarege, 2020) — an issue particularly problematic in areas with limited parking spaces. Furthermore, short-term renters may not be as invested in the community as long-term residents. This detachment can result in an increased likelihood of disruptive behaviour such as noisy gatherings, parties

and waste generation (Williams, 2016). Failure to properly manage these can become a significant source of local resident frustration.

On top of social disruptions, the widespread adoption of P2P accommodation has led to significant changes in neighbourhood composition and urban fabric as tourists increasingly infiltrate residential areas, thereby creating new urban tourist spaces. This contributes to the pressures of tourism and results in the gentrification of areas that were previously residential in nature, transforming them into commercialised zones catering to tourists (Stergiou & Farmaki, 2020).

More specifically, the influx of short-term renters can strain local resources and amenities (Gutiérrez et al., 2017), such as public transportation, local shops, and public services, thereby affecting the quality of life for residents. Furthermore, P2P accommodation can transform residential areas into de facto commercial spaces, potentially infringing on local zoning regulations and disrupting the residential character of a neighbourhood (Melián-González, Bulchand-Gidumal, & Cabrera, 2022; González-Pérez, 2020). This can lead to conflicts between residents and property owners, and in extreme cases, can disrupt the entire characteristic of a neighbourhood as a residential area primarily inhabited by permanent residents.

Several scholars (Wachsmuth & Weisler, 2018; Cocola-Gant & Gago, 2019) argue that the proliferation of the P2P market, under the backdrop of touristification, intensifies the gentrification of these urban areas (Cocola-Gant, 2018). Tourism is considered to be a factor causing the displacement of residents, professionals, and space users (Robertson, Oliver, & Nost, 2020; Neuts, Kourtit, & Nijkamp, 2021).

P2P-accommodation-induced gentrification is different from traditional tourism gentrification, Wachsmuth and Weisler (2018) utilise the rent gap model to describe this process. They propose that the opportunity to earn higher rental income via P2P platforms, such as Airbnb, increases the "potential ground rent" for properties in certain neighbourhoods, without requiring owners to redevelop or renovate their properties. This widens the gap between the actual ground rent (current rental income) and potential ground rent (possible Airbnb income). Airbnb allows this rent gap to be capitalised upon swiftly and with minimal investment, by simply converting long-term rental units to short-term rentals. In contrast to traditional gentrification, which necessitates major redevelopment to close rent gaps, Airbnb enables gentrification without redevelopment (Cocola-Gant & Gago, 2019; Shabrina, Arcaute, & Batty, 2021; Cheung & Yiu, 2022). Sequera & Nofre (2020) found Alfama has been transformed into an ‘outdoor hotel’, with a high number of Airbnb apartments. The flood of tourists and foreign investors has led to the expulsion of low-income residents and altered the traditional urban landscape.

Building on this, the phenomenon of gentrification often leads to the displacement of long-term residents, can be understood through three distinct mechanisms (Wachsmuth & Weisler, 2018). Firstly, there is the direct migration of

existing residents (Cocola-Gant & Gago, 2019). This is often a result of the financial incentives offered by short-term accommodation platforms, which can make it more profitable for property owners to rent their homes to tourists rather than long-term tenants. Secondly, exclusive migration occurs due to a decrease in housing supply and an increase in rents (Grisdale, 2021), making it nearly impossible to secure housing. This combination of housing scarcity and increased rents can make it nearly impossible for individuals, particularly those struggling financially, to secure housing in gentrified areas. Finally, migration pressure arises from the strain placed on community services and facilities by large demand for visitor use (Ioannides, Röslmaier, & van der Zee, 2019). The differing usage patterns and needs of tourists and long-term residents can create tension and conflict, prompting residents to relocate to areas where community resources are more aligned with their needs.

2.5 UK housing systems

Given the renewed attention to gentrification in the context of the rise of P2P accommodation, it is pertinent to scrutinise the current state of the UK housing system. This section investigates the housing system in the UK, with a particular emphasis on the scarcity of affordable housing options and the shifting trend of viewing houses as financial assets.

2.5.1 Limited affordable housing

The UK has long been criticised for high house prices and the limited supply of affordable housing. House prices in the UK have had a long period of growth, with the average house price more than doubling from £80,000 in 2000 to £180,000 in 2008 (Land Registry, 2021). The 2008 financial crisis saw assets shrink sharply, falling by 18.7%, and then house prices opened up further after a period of shock and volatility between 2010-2013 (Chandler & Disney, 2014). Despite the implementation of a five-year housing land supply since 2012 and help to buy, there has been little success and many local authorities have failed to meet set targets (Harris, Webb, & Smith, 2018). The most prominent example is London, where house prices have been kept at a high level due to the high average household income and the attractiveness of domestic and foreign investors. At the same time, the housing supply has failed to respond to the needs of the surging population and employment or to reach the due planning output (Hincks & Wong, 2010; Mulheirn, 2019). Over the three years (2016/17 to 2018/19), only a net 107,800 new homes were completed in London (Cosh & Gleeson, 2020). The increase in delivery is still below the 2016 London Plan which worked on the assumption of an annual increase of at least 42,000 net additional homes. The same housing shortfall was found in Scotland, albeit with their own planning system. Edinburgh is the least affordable city in Scotland, rents have gone up by annually 6% in five years (ESPC,

2010), and house prices are around eight times the average earnings in 2020. There was a housing supply target of 3,283 homes from 2018 (SESplan, 2018), but there were no more than 3,000 net completions in 2018 and 2019. Some international cities across the globe like New York City, San Francisco and Paris are also facing their own residential struggles. Many first-time homebuyers in UK cities such as London, Manchester, Bristol have been experiencing hardships with worsening affordability to purchase their own homes and are beginning to protest the lack of adequate affordable housing (Hincks, Webb, & Wong, 2014; Harris, Webb, & Smith, 2018; Wallace, 2019).

The advent of P2P accommodation platforms is likely to add to the already severe housing burden (Wachsmuth & Weisler, 2018). Such platforms claim that the sharing economy business model provides a trading platform for the public to dispose of idle resources, and that "sharing" can improve the efficiency of idle space use and generate additional income for multiple residences (Gössling & Hall, 2019). However, to date, many critics (Sainaghi & Baggio, 2020; Kathan, Matzler, & Veider, 2016) have pointed out that the practice of home-sharing has directly or indirectly affected both the traditional tourist accommodation industry and the housing market by unforeseen listing competition, and may not even be effective in increasing housing utilisation and economic income for homeowners (Schor, 2016).

The market share expansion of these platforms has gradually accumulated and its erosion of housing and community bonds has started to appear (Apostolidis & Brown, 2021). There have been some protests in New York, San Francisco and Edinburgh against Airbnb (Pooran; Truong; Gunter, Önder, & Zekan, 2020; Booth, 2015), the conflict between the desire of some residents in Barcelona to protect their communities and the profit motive of P2P accommodation platforms has been intensified into violence. These occurrences cast doubt on a basic assumption that still underpins the sharing economy literature that P2P lodging improves home utilisation efficiency. The fact that tourist arrivals might exacerbate housing affordability and deprivation further complicates the issue by introducing a third actor, the individual or institutional investors who own the rented dwelling. It is consequently vital to comprehend these new gentrification processes.

2.5.2 Financialisation of housing

The notion that finances are essential to urban economic development is held in high regard. Financialisation adds momentum to financing the construction of global cities and it has been particularly evident in the UK housing market. The preliminary development of housing financialisation has brought about an increase in homeownership rates and contributed to the formation of underused housing resources, but many academics have reiterated the overdeveloped financialisation in explaining the undermining of homeownership by turning

housing into a vehicle for wealth and investment (Lennartz, Arundel, & Ronald, 2016; McKee, 2012).

Finance has accumulated power since 1979 and the UK has gone through two full financial cycles (Blakeley, 2021), from the Conservative government's unbundling of liquidity, through the speculative feedback loop brought about by the 'right to buy' and rising credit levels, through the burst of the housing bubble leading to the recession in 1993, to the boom again by 2008. This series of operations is inextricably linked to credit growth and financial deregulation (Grafe & Mieg, 2019), when mortgage lending grew from 30% of GDP in 1990 to over 60% in 2008 (Ryan-Collins, Lloyd, & Macfarlane, 2017). This apparent rise in homeownership was accompanied by inflation in personal housing mortgage lending (Keasey & Veronesi, 2012).

Since housing prices dropped by 30% after the subprime crisis (Ball, 2011), investors could use their surplus funds to buy relatively inexpensive real estate stimulated by the central bank's QE. As part of this process, financial instruments such as REITs were introduced in 2007 (Jones, 2007) and capital gains tax exemption in 2015. At the same time, build-to-rent funds increased rapidly, the government provided £1.1 billion in incentives for market and affordable housing in 2013 (Nethercote, 2020) that allowed for the conversion of offices to residences without planning permission. Converting purpose-built-student-accommodation to a tradable investment trust also provides a precedent for the financialisation of the private rented sector that allows investors to benefit from the acquisition of property without having to purchase it.

A series of financialisation policies adopted for the recovery of the economy after the financial crisis turned real estate into 'just another asset class' (Van Loon & Aalbers, 2017) and have caused structural changes in homeownership. The government's shift to a market orientation in housing has only added to the severity of the already existing housing problem. The homeownership rate fell from 73.3% in 2007 to 65.2% in 2019 and especially for young people it has fallen sharply (Ronald & Kadi, 2018; Corlett & Judge, 2017). Housing resources were consolidated again, causing a structural reversal from owner-occupation to renting (Beswick et al., 2016). Between 2007 and 2017, the number of households in the private rented sector increased by 1.7 million, implying that 20% of Britons live in private-rented housing, with more than a third being families (ONS, 2019).

In retrospect, some scholars believe that the global financial crisis was the trigger that pulled the sharing economy and P2P accommodation into high gear (Demary, 2015), multiple property ownership accumulation fosters the revival of the private rented sector and the emergence of the P2P rental market with implications for the structure and composition of the UK housing system.

The sharing economy has been praised as an innovation though, it is potential to disrupt existing industries (Stemler, 2016; Codagnone, Biagi, & Abadie, 2016). It

is because of the involvement of venture capital that P2P accommodation is subtly changing the use of houses. REITs can primarily repurpose entire buildings, and P2P accommodation can be seen as engaging in a similar process. Landlords can convert their housing units from private rentals to short-term rentals with a few simple actions on P2P platforms, which does not require much effort to connect underutilised housing to a wider range of customers and thus capture value (Espinosa, 2016; Ioannides, Röslmaier, & van der Zee, 2019). P2P accommodation platforms hence offer a new way of operating for buy-to-let investors and an alternative way of financialising housing. Some authors argue that P2P platforms are not just intermediate goods of production, distribution, and consumption; they can also act as rentiers through the subtle conversion of residential real estate into holiday lettings thus profiting in a more flexible and heterogeneous manner (Cocola-Gant & Gago, 2019; Grisdale, 2021). Rentierism was prevalent in the aftermath of the financial crisis (Christophers, 2019; Sadowski, 2020; Müller, Murray, & Blázquez-Salom, 2021). Rental investment in the private sector has grown significantly due to a shift away from social housing and an increase in demand for rental properties. The sharing economy has been turned into a way for individuals to store surplus funds, and even professionalised as a commodity with the buy-to-let model which has replaced the financialisation of housing through the buy-to-sell model (Simcock, 2017).

In this context, the rise of Airbnb and other P2P accommodation platforms has the potential to play a catalytic role in this transition, not only because P2P accommodation has created a flexible and efficient business model, but also because they have accelerated the process of financial globalisation of the rental housing market. Nonetheless, there are fewer studies examining the disruption of local neighbourhood spaces by the rise of P2P accommodation platforms in the context of the financialisation of housing, and thus merit further exploration.

2.6 Housing financialisation, peer-to-peer accommodation and professionalisation

It is clear that substantial issues such as the scarcity of affordable housing and the financialisation of housing persist in the UK. However, this trend coincides with the subtle yet influential development of P2P accommodation platforms, which have ushered in a process of professionalisation in financialising housing. This shift reflects the evolution of property rental from casual, occasional renting to a more strategic approach. This section clarifies this practice of financialisation in the housing market entangling with the professionalisation of P2P accommodation.

2.6.1 Economic welfare impact

P2P accommodation has indeed revolutionised the landscape of property utilisation, offering every local resident the opportunity to become a stakeholder in the lodging industry. This evolution has not only transformed the way visitors experience destinations, but it has also fundamentally altered the socio-economic dynamics within communities.

At the heart of P2P accommodation is its ability to democratise participation, empowering individuals to play an active role in shaping and benefiting from the local hospitality landscape (Schor, 2016). This transformative impact stems from the platform's capacity to harness the untapped potential within the private homes of local residents. By seamlessly integrating these unused spaces into the accommodation sector, P2P platforms foster a more distributed and inclusive model of economic engagement (Kadi, Plank, & Seidl, 2019). The traditional narrative of tourism revenue being funnelled solely through established hotel structures is being reimagined (Xie & Kwok, 2017), as diverse households become integral contributors to the economic fabric of their communities.

Proponents of P2P accommodation argue that the redistributive effects of these platforms play a pivotal role in reducing socio-economic disparities within local communities. Firstly, these platforms facilitate revenue generation for both operators and P2P platforms. Property owners become micro-entrepreneurs, with many citing the pursuit of additional income and the alleviation of mortgage burdens as primary motivations (Guttentag et al., 2018). From a spatial perspective, the impact is twofold. On the one hand, in and around traditional tourist and business hubs, short-term renters often utilise local accommodations for their temporary stay. During peak tourist seasons, P2P platforms effectively address the issue of local capacity constraints, while enabling low-income groups to benefit from an additional income source (Farronato & Fradkin, 2022; Casamatta et al., 2022). On the other hand, these platforms open up new dimensions in tourism and disperse accommodation supplies not only within urban landscapes (Falk, Larpin, & Scaglione, 2019; Domènech & Zoğal, 2020). Airbnb, for instance, is redirecting urban tourists towards areas with limited hotel presence. By diversifying accommodation options and making them more affordable, Airbnb enables a broader demographic to explore and visit these less frequented or rural regions. Consequently, the arrival of tourists can increase spending in areas that might have been overlooked (Agarwal, Koch, & McNab, 2019; Mahadevan, 2022), contributing significantly to the redistribution of welfare within these regions.

Moreover, P2P platforms have the potential to introduce new economic activities for municipal authorities (Cors-Iglesias, Gómez-Martín, & Armesto-López, 2020), reshaping the market structure of local communities and infusing substantial consumer power. By stimulating the tourism sector, these platforms act as catalysts for economic development, generating numerous employment opportunities within society (Fang, Ye, & Law, 2016). Evidence from New York

indicates that Airbnb visitors frequently patronise local restaurants, and the intensity of Airbnb activities correlates with a notable growth in restaurant employment within the community (Basuroy, Kim, & Proserpio, 2020). Evidence spanning 12 metropolitan areas in the US also suggests a synchronicity between the growth in tourism retail and services, the inflow of tourists, and the expansion of P2P accommodation (Dogru, Mody, Suess, McGinley, et al., 2020). This interplay signifies an anticipated growth in retail and service businesses associated with the hotel industry, aligning with the increasing demand driven by P2P accommodation's influence on tourist preferences. The P2P platform's ability to redirect consumer spending towards local businesses not only amplifies the economic impact but also strengthens the symbiotic relationship between P2P accommodation and local economies (Shabrina, Buyuklieva, & Ng, 2020). This economic synergy is poised to create a ripple effect, fostering a more dynamic and diversified market environment within urban and peri-urban spaces.

However, some studies present opposite conclusions like the exacerbated income inequality and the potential for over-tourism. Törnberg (2022b) examines the revenue distribution of Airbnb markets in 97 cities and regions, finding that a majority of the market revenue tends to go to about 10% of the hosts, resulting in high revenue inequality. It also estimates the racial and gender revenue gaps, finding that Black hosts receive on average 22% less revenue for their listings, and women an average of 12% less. Mermet (2021) uses Reykjavík, Iceland as a case study to analyse whether Airbnb contributes to wealth redistribution or exacerbates existing social inequalities. The study finds that affluent households are more likely to benefit from Airbnb, as they are overrepresented among hosts and tend to have more profitable listings, while low-income households are underrepresented and have less profitable listings. This suggests that Airbnb may reinforce inequality patterns rather than evenly distribute tourism income across different social groups.

2.6.2 Housing financialisation through professionalisation of P2P accommodation hosting

Early on, Airbnb rents out entire properties or vacant rooms on the platform based on the principle of revitalising unused housing resources for mutual benefits, while a growing number of scholars are finding clues to the professionalisation and commercialisation of P2P accommodation as it grows. This has resulted in a shift in the way properties are managed, with many property owners now employing professional property management companies to manage their properties. This professionalisation of hosting has further contributed to the financialisation of housing, where housing is increasingly viewed as a commodity or an investment, rather than a basic human right or a social good, as it has made it easier for property owners to generate income from their properties.

Some landlords use their homes as real hotels rather than as home-sharing in their spare time. These landlords usually rent for the whole year and may be awarded the title of Super Host or may manage more than one listing. Professional landlords are performing better in terms of available properties, have an increasing share of the platform's total revenue (Xie, Heo, & Mao, 2021) and are considered to be operating in a more business-like manner than the 'average landlord'.

The ability to manage more than one property is unevenly distributed, confirming the growing importance of 'professional hosts' and 'professionalisation' on the platform (Gil & Sequera, 2020). Existing research has illuminated the proliferation of 'private hotels' (Wachsmuth & Weisler, 2018; Clancy, 2020). Despite the fact that the prevalence of professional multi-unit hosts may not be uniformly high across all cities, there is a discernible trend wherein they are progressively gaining dominance in terms of listing numbers compared to their single-unit host counterparts (Kwok & Xie, 2019; Abrate, Sainaghi, & Mauri, 2022). In cities such as London, Rome, Madrid, Barcelona, and Lisbon, the proportion of listings controlled by multi-hosts is 49%, 62%, 55%, 65%, and 67% respectively (Demir & Emekli, 2021; Abrate, Sainaghi, & Mauri, 2022), and the dominance of multi-hosts is even more pronounced in city centres.

Many studies of the North American market have shown that professional hosts are able to achieve better profits than non-professional hosts. For instance, in Chicago, professional hosts earn 16.9% more daily income on the properties they manage, and their occupancy rate is 15.5% higher (Li, Moreno, & Zhang, 2016). Evidence from California also indicates that listings managed by multi-listing hosts have a monthly income per available night that is 27.8% higher than listings managed by single-listing hosts (Xie, Heo, & Mao, 2021). Kwok & Xie's (2019) results for 10 major U.S. markets also show that listings managed by multi-listing hosts due to efficient management have significantly greater income performance compared to listings managed by single-listing hosts. Interestingly, multi-listing hosts' price positioning performs better in terms of income compared to the average prices of other nearby competitors. In the analysis of two major Italian cities, multi-listing hosts tend to have more price variability and outperform single-listing hosts in terms of revenue performance (Abrate, Sainaghi, & Mauri, 2022). Analysis of Airbnb listing bookings and revenue data has provided much insight into the share of such professional hosts in the STR market. It suggests that professionalisation is pushing more income towards a narrower segment of host groups. Professional hosts, who are increasingly seen as micro-enterprises rather than 'ordinary hosts' (Stabrowski, 2017; Mahmuda et al., 2022), are taking a larger share of available listings and total platform income.

In addition, the mounting number of investment companies managing P2P letting on behalf of third parties reflects an endeavour to imbue the market with a

greater degree of professionalism and efficiency (Cocola-Gant & Gago, 2019). They are more flexible in adopting revenue management strategies such as dynamic pricing, minimum nights and cancellation policies, and invest time and training in operational excellence and service management (Gibbs et al., 2018). Daily data from the market is collected, processed and advised to owners and investors.

This professional deployment of revenue management tools starkly contrasts with the approaches of non-professional agents, subsequently translating into significant differences in market outcomes (Li, Moreno, & Zhang, 2016). The rise of vertically integrated and technology-driven company landlords begins to play a pivotal role in shaping the development of the short-term rental market. Xie & Mao (2019) discovered that the locational choice strategies adopted by professional multi-unit hosts have a positive impact on the perceived quality and revenue performance of listings, particularly with the expansion of the investment portfolio. The P2P rental market is increasingly dominated by business owners, namely professional property managers, who aim to optimise profits derived from real estate assets while providing bespoke hosting products (Gil & Sequera, 2020; Agustín Cocola-Gant et al., 2021). As such, they can use P2P platforms to connect to international markets and expand to global investors. Many international hubs around the world are experiencing a process of financialisation of housing driven by professionals specialising in P2P home sharing that are not in line with the principles of the sharing economy (Fields & Rogers, 2021). These findings epitomise the opportunistic and commercially oriented nature of professional hosts on the platform (Dogru, Mody, Suess, Line, et al., 2020).

The P2P accommodation industry has become more consolidated and stable as a result of the professionalisation of the sector. However, this also means that it is deviating from the original ideals of the sharing economy. Individual hosts who do not adopt professional standards and practices may struggle to compete and survive in the market (Agustín Cocola-Gant et al., 2021; Jia & Wang, 2021). Some hosts on Airbnb are trying to formalise their practices by organising themselves into associations or networks, while others are rejecting the increasing professionalisation and leaving the platform altogether (Farmaki, Christou, & Saveriades, 2020). Airbnb's original vision of the sharing economy has been disrupted. In this instance, it may not increase the total value, supply, or profits generated by the platform, nor promote long-term sustainability and growth in the sharing market.

2.7 Conclusion

This chapter establishes the theoretical background of the study and attempts to integrate previously underexplored literature to provide a cohesive elucidation of P2P accommodation and gentrification. Existing literature on the rise of P2P accommodation platforms has touched on the transformation of the tourism

industry and urban environments, contributing to the broader issues surrounding gentrification and touristification (Sequera & Nofre, 2020; Mermet, 2022). It explores how the sharing economy makes use of underutilised assets, bringing about new innovations and experiences in the tourism sector. However, P2P platforms also shape spatial imaginaries, reconfiguring urban spaces, a concept encompassed within the notion of platform urbanism. While P2P accommodation may not necessitate large-scale redevelopment, its more subtle impacts can promote gentrification by increasing potential ground rent in residential areas. Additionally, the expansion of P2P platforms aligns with housing systems facing scarcity, such as the affordable housing shortage in the UK, potentially exacerbating existing issues. The professionalised operation of P2P accommodation reflects the evolution of housing into a financialised commodity. Therefore, the commercialisation and financialisation of P2P accommodation, while holding the promise of increased democratic participation, deviate from the early ideals of the sharing economy.

However, current literature exhibits gaps and limitations. Most discussions revolve around categorising the positive and negative impacts of P2P accommodation (Lima, 2019; Dogru, Mody, Suess, McGinley, et al., 2020), with critical research on its complex dynamics and misuse remaining scarce. For instance, while literature acknowledges that P2P accommodation contributes to gentrification, little attention is given to how these P2P short-term rentals open rent gaps, the capital sources forming rent gaps, how these platforms strategically mobilise financialisation practices to exploit rent gaps, and where the geographical manifestations of rent gaps occur. More empirically grounded research is needed to understand how P2P accommodation platforms adeptly reshape urban spaces, housing market structures, and neighbourhood economies in different contexts. Furthermore, literature has yet to fully place P2P accommodation platforms within the unexpected shocks of pandemics.

In conclusion, although existing literature offers valuable insights, there is further theoretical and critical space for understanding how these platforms exercise power by proprietary control of urban data flows, thereby leveraging rent gaps. While literature indicates the professionalisation trend of P2P accommodation, more investigations are required to comprehend how asymmetric power within P2P platforms might exacerbate spatial inequalities.

CHAPTER 3
CONCEPTUAL FRAMEWORK AND METHODOLOGY

3.1 Introduction

This chapter sets out a rigorous arrangement for addressing the research questions and filling in the research gaps, introducing the methodologies applied in the subsequent empirical chapters (5-8). In response to the relative paucity of UK-focused studies in this domain, the investigation concentrates on the progression of P2P accommodation in three British cities.

The chapter initiates with a conceptual framework that aligns the research project's aims with a reworked rent gap theory, tailored to the sharing economy paradigm. The chapter proceeds to introduce the rationale behind the selection of the study area, emphasising the significance of secondary data that forms the bedrock of the thesis. The study's temporal scope and geographical focus stem from both the trend of Airbnb P2P rental proliferation and the impact of COVID pandemic. A variety of datasets, which include Airbnb listings, property market data, and geo-demographic classifications, are integrated to create a robust research design. In the latter sections, the chapter delineates the analytical methods selected for data interrogation within the thesis, articulating the objectives, computational processes, and the interpretative frameworks for each method. The amalgamation of these methodologies offers novel insights into the disruption of P2P accommodation in neighbourhoods.

3.2 Conceptual framework

The theoretical underpinnings of the rent gap model are intuitive and straightforward: if the potential ground rent in a given area outstrips the actual (or capitalised) ground rent, that area will most likely undergo redevelopment and gentrification (see Figure 3-1). Depending on the reality of the situation, Smith formulated it by defining the model to which it applied as rehabilitated development (Smith, 1982). P2P accommodation has different regulatory requirements, commercial operations, and spatial arrangements, which necessitate a recalibration of the rent gap theory framework. An important issue, however, is that 'potential ground rent' and 'actual ground rent' are very abstract rather than widely observed concepts, making it very difficult to measure them quantitatively in practice (Clark, 1995). The two most readily observable concepts, P2P rental revenue and private rental revenue can largely serve as proxies for

measuring potential ground rent and actual ground rent to operationalising this model.

Unlike traditional urban redevelopment where the consolidation of capital in real estate that cannot be transferred, the shift in industrial centres, the depreciation of buildings, etc. lead to the decline of urban areas and the fall in actual ground rent, the opening of rent gap due to home-sharing does not require regional redevelopment. Instead, technology-fuelled P2P accommodation platforms do not rely on lower actual ground rent, but rather increase potential ground rent by reducing transactional costs and creating demands for new forms of lodging (Tussyadiah & Pesonen, 2018), thereby enlarging rent gap. The P2P accommodation business model does not involve the bulldozing of already built-up areas, which skips the cost of demolition compensation and redevelopment investment, and is simply a purpose-shift of existing housing stock, but it is emerging in the sense of acquiring housing stock from the private rented sector and encroaching on the market share of hotels (Cheng, Mackenzie, & Degarege, 2020; Zervas, Proserpio, & Byers, 2017).

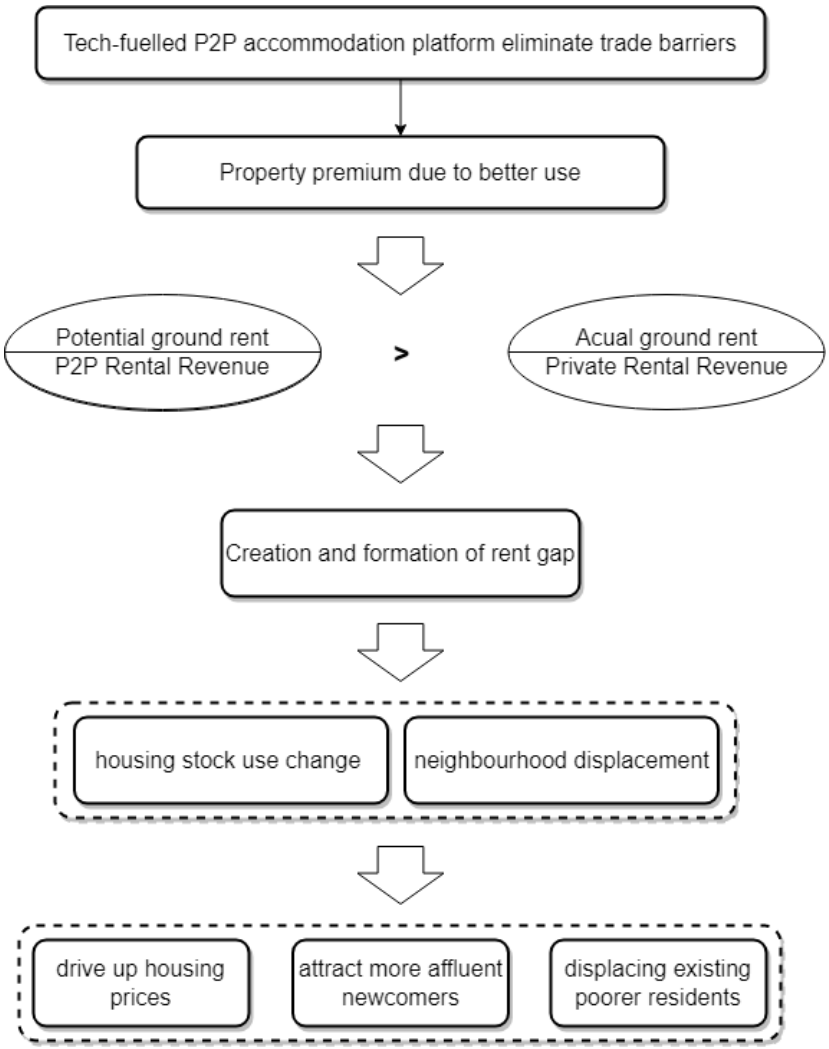


Figure 3-1 Conceptual framework of creation and formation of rent gap. (Own elaboration)

Housing stock competition is primarily driven by profit-seeking motives (Figure 3-2). This shift is primarily due to the rent gap that often exists between P2P and private rentals, sparking a strong demand from homeowners seeking to maximize the rental income, thereby removing their previously available properties from the regular housing market. Besides, these platforms have also facilitated the financialisation of housing, attracting more individuals and businesses to invest in P2P accommodation, which further exacerbates the plundering of housing stock.

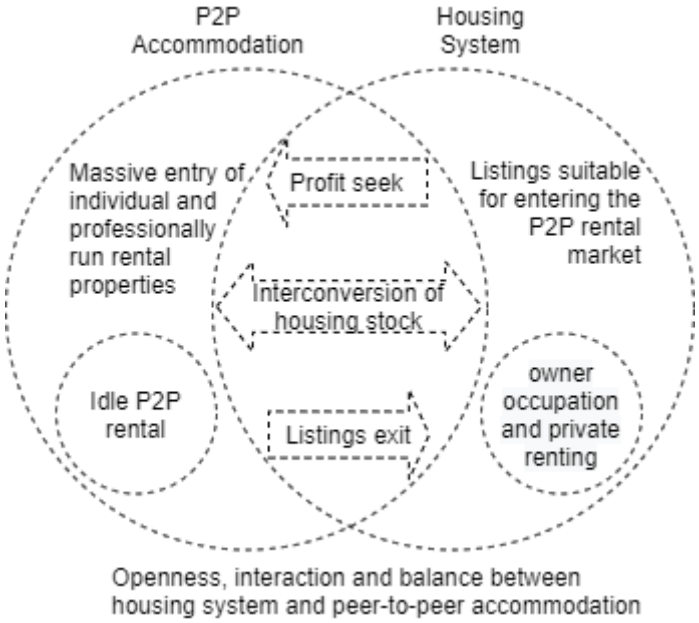


Figure 3-2 The interaction between P2P accommodation and housing system. (Own elaboration)

In this process, commercial operators, spotting the profit margins, began to deploy the P2P accommodation market, and these professional hosts are contributing to the professionalisation of Airbnb (Agustín Cocola-Gant et al., 2021). The trend of amateur hosts transitioning to professional status is becoming an integral part of the operational strategy. This level of professionalism is reflected in the number of listings they manage, means they adopt and their experience in doing so (Kwok & Xie, 2019; Xie & Mao, 2019). It is a dual-faceted activity that not only provides supplementary income but also serves as a speculative venture for individual landlords and commercial operators. The composition and characteristics of the platform's hosts have changed and are gradually departing from the shared economy in the true sense of the word.

At present, different types of hosts coexist in the Airbnb market (e.g., property investors, house agents, professional managers, individual landlords, etc.) and can

basically be categorised into “professional operators”, "individual professional hosts" and "individual amateur hosts", depending on their mode of cooperation or business model practices (Colomb & Moreira de Souza, 2023). The performance of the "investor" and "professional" landlords among the professional landlords is distinct from the traditional economy of the Airbnb model, which is far from managing the principles of the sharing economy and is solely professional in terms of the increase in revenue claims. Professional hosts are represented by the number of listings they manage, their expertise in handling these listings, the type of listings and the year-round availability (Deboosere et al., 2019; Grisdale, 2021; Bosma, 2022). Professional hosts often have more than one property in their hands and invest a great deal of time and money to maintain their operations, thereby generating a steady and substantial revenue stream from entire homes letting (Dogru et al., 2021). Airbnb gives hosts who have met specific performance standards, such as high ratings, a low cancellation rate, a significant number of stays and exceptional service standards, a superhost badge. Many super hosts treat their Airbnb operation as a professional business, delivering professional-level hospitality, also representing a form of service professionalisation.

The escalating rent gap is inextricably linked to the shift from amateur to professional supply in the P2P accommodation market (Agustín Cocola-Gant et al., 2021). The reasons for this professionalisation are primarily reflected in scale effects, reducing information asymmetry, monopolistic market competition incentives, and knowledge spillovers (Santiago-Bartolomei, 2019). Initial amateur home-sharing activities may not have provided a satisfactory experience in terms of in-house facilities, sanitary conditions, and service attitudes. The deepening of professionalisation has compensated for the operational deficiencies of amateur landlords, not only in form but also in actual experience (Casamatta et al., 2022). Professional organisations are better equipped to handle customer concerns, and their operations are often more streamlined and efficient. As the scale of industrial professionalisation agglomeration expands, the total output on the platform also increases. In addition, short-term rentals reduce intermediate input costs due to their resource reuse characteristics, lowering the cost of circulation of accommodation factors and accelerating the speed of circulation (Dolber et al., 2021). Human capital has a certain specificity, and professional operation can improve the efficiency of housing and human resources within the region, thereby saving management costs in the intermediate links. At the same time, the competition among landlords on the platform becomes more intense with the reduction of external transaction costs, especially in adjacent areas. The result of specialised competition is to cause the industry division of labour to become more refined, and the mutual exchange between professionals promotes the overall operational capability (Bosma, 2022), greatly promoting the increase in the professionalism of the P2P accommodation market.

While fuelled by market professionalisation, the rent gap is in fact underpinned by external conditions. Regarding the capital source of rent gap formation, both traditional private rental income and the new style P2P rental income cannot be separated from the spillover effect of external investment and services. The capitalisation effect of public infrastructure in a neighbourhood is often considered to be the key source of the potential ground rent and capitalised ground rent (López-Morales et al., 2019). A neighbourhood's commercial prosperity, accessibility, and abundance of amenities should make a neighbourhood more valuable, as diverse amenities accumulate lucrative investments on the one hand and make it easier for residents to access the services offered around the neighbourhood on the other (Figure 3-3). The advent of P2P accommodation has further magnified this value. When online transactions became more accessible, some previously underutilised amenities such as cultural cachet, leisure and tourist attractions were activated thereby generating greater premiums (Tafesse & Dayan, 2023). The investment multiplier effect as well as the agglomeration of population and commercial services in some new areas can also spill over into the formation of the rent gap (Deng, Nanda, & Ong, 2019).

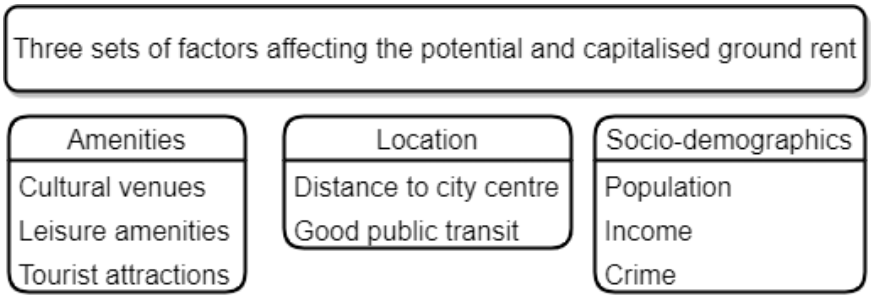


Figure 3-3 Key factors affecting the ground rent. (Adapted from Tafesse & Dayan, 2023)

Given this backdrop, the professionalisation of P2P accommodation undeniably influences neighbourhood housing prices and is intrinsically linked to the fluctuating dynamics of the rent gap. Its impact, therefore, is twofold.

On one hand, the professionalisation of P2P accommodation has been identified as a potential catalyst for the appreciation of housing prices in neighbourhoods, thereby fostering gentrification through various mechanisms:

- Higher potential rental income (Wachsmuth & Weisler, 2018; Yrigoy, 2019). The increased revenue stream, resulting from home sharing, gets capitalised into higher property values. The allure of this income potential attracts commercial investors and speculative buyers, intensifying competition and further inflating property prices.
- Scarcity of long-term housing (Simcock, 2017). As more entire units get converted to P2P accommodation, it decreases the supply of long-term housing available for sale.

- Improved amenities (Dredge & Jenkins, 2003; Cheung & Yiu, 2022). The influx of tourists spurs new businesses, hotels, restaurants, and improved infrastructure. These amenities increase the desirability and values of nearby properties.

On the other hand, it is imperative to recognise that the professionalisation of P2P accommodation can, conversely, contribute to a depreciation in neighbourhood housing prices. This can occur due to an oversaturation of short-term rental properties, which may undermine the stability of the local housing market. Such a scenario could potentially result in displacement through various avenues:

- Nuisance and irritation (Gurran & Phibbs, 2017). In neighbourhoods dominated by single-family homes or low-density housing, the influx of Airbnb guests can cause annoyance for residents (e.g., noise, crowdedness, and littering), making the neighbourhood less desirable for owner-occupiers and long-term residents.
- Alteration of neighbourhood character (Bao & Shah, 2020). The presence of short-term rentals can alter the character of neighbourhoods, displacing long-term residents, which makes the neighbourhood less desirable for potential buyers.

The rent gap, therefore, is not a static or uniform phenomenon, but a dynamic and heterogeneous one that varies across time and space. The dual impact of the professionalisation of P2P accommodation underscores the complexity of its role in shaping neighbourhood housing dynamics.

Thus, with respect to the geographic embodiment of rent gap creation, opening rent gap is likely to be particularly concentrated in two typical neighbourhood types: the first is in some of the established areas around central business districts of the city where housing stock is abundant and the proportion of short-term tourist accommodations (Shabrina, Buyuklieva, & Ng, 2020) such as midrange hotels, budget hotels/motels, hostels and B&B has historically been high, namely where there is a pre-existing dense leisure travel and business travel tourism demand, P2P accommodation is used to cater to the needs of tourists; (2) Residential areas with strong cultural identity (González-Pérez, 2020; Maginn, Burton, & Legacy, 2018), leisure facilities and good public transport (Wachsmuth & Weisler, 2018). The creation of rent gap tends to be based around traditional tourist areas and those with high international recognition such as cultural and heritage sites and entertainment and consumer venues. There also tends to be a difference in preference between hotel and P2P users in terms of their choice of travel transportation mode. The majority of hotel users are business people, and business cars are more likely to be used than public transportation when travelling. However, in the case of P2P accommodation, public transportation is the more important mode, as users consist primarily of incoming travellers who may not

have an alternative mode of transportation or simply walk instead, meaning that aspects of public transportation such as mobility and accessibility are important to the location of short-term rental units. Conversely, in low-income and minority communities that lack popular cultural amenities, and in suburban areas with poor public transportation connections to city centres that have not historically hosted a large number of tourists, short-term rental demand may be weak with insufficient incentive to generate the rent gap.

The opening of the rent gap allows speculative profits from the reuse of the housing stock to rise, and when the rent gap is large enough, capital will reverse the cycle and move to the urban P2P rental market (August & Walks, 2018). With a shortage of land supply for new development in the city and no increase in housing supply, investors will look to convert existing housing stock into P2P rentals for profits, bidding up property prices for higher returns, which will leave first-time buyers and long-term tenants without more options and thus facing a more challenging life if the supply of affordable housing does not follow in time (Zou, 2020; Liang, Yeung, & Au, 2022). The housing is professionally packaged and operated to improve living conditions and the environment, attracting groups of visitors from outside the city, replacing low-income groups of people who previously rented housing on a long-term basis, and gentrifying some urban areas (Gil & Sequera, 2020). The technologically-enabled, culturally-mediated, capital-led and geographically-uneven rent gap is opened up by cultural, tourism, leisure and sports amenities (Wachsmuth & Weisler, 2018, 2018; Horn & Merante, 2017; Sheppard & Udell, 2016), and closed again as the P2P rental and private rental market reach a new equilibrium. It is a relatively temporary rent gap from the point of view of the overall local housing market, as its creation is not preceded by a sustained phase of speculative activity (Guinand, 2017), P2P rentals is initially low in supply while demand is high due to novelty, and as market supply increases and novelty curiosity subsides, actual rents for P2P lodging gradually fall back after experiencing an acute increase. This process is a regrouping of existing resources and is exactly "gentrification without redevelopment" (Wachsmuth & Weisler, 2018).

The unexpected COVID-19 outbreak disrupted the global urban economy and the P2P accommodation sector in 2020. This halted the 'normal' functioning of cities and challenged the multidimensional links between cities (Ray et al., 2022; Zachreson et al., 2021). Some commentators wondered if COVID-19 had 'disrupted the disruptor' (Dolnicar & Zare, 2020, p. 1). The pandemic invoked responses in hosts and agents that involved weathering the storm or mitigating the impacts of the pandemic through more 'active' responses. Some short-term rental landlords and managers moved their accommodations to long-term ones, while others adapted their hosting strategies depending on their operating models and motivations (Dolnicar & Zare, 2020; Farmaki, Christou, & Saveriades, 2020;

Calatayud, 2020; Chen et al., 2021; Leoni & Nilsson, 2021). However, the impacts of COVID-19 on P2P accommodation were uneven and resilient across different subdivisions of Airbnb listings (Dogru et al., 2023), and especially in deprived neighbourhoods, communities may face multiple difficulties during and after the pandemic. Considering this, the study builds on the emerging work on P2P-accommodation-induced gentrification and extends it through the highly important case of major cities in the UK — an important tourism capital destination. As the case in which gentrification prompted by P2P accommodation and social change has unique patterns, this study will revisit the rent gap theory and provide a more nuanced understanding of this new form of gentrification.

3.3 The study area

There has been enhanced attention with regard to the overlap between P2P accommodation and housing markets, but it is mostly limited to development issues in cities in the United States and continental European cities with abundant tourist resources and the voices of UK cities are seldom heard in the scholarly literature. Furthermore, difficulties in drawing direct international comparisons stem from a heterogeneous mix of administrative structures, divergent planning systems, and varied levels of economic development when contrasted with the UK. To bridge this knowledge gap, focusing attention on the UK landscape becomes imperative.

In the UK, Airbnb has witnessed exponential growth, particularly catalysed by the burgeoning tourism industry. Visit Britain's survey indicates a staggering 11.76 million trips incorporating self-catering accommodations in Great Britain during 2019 (VisitEngland, 2019). Between July 2017 and July 2018, the platform observed roughly 223,200 active UK listings and accommodated about 8.4 million guests. Dominating Europe's short-term rental market, Airbnb accounted for 62% of the sector’s revenue as of 2018 and its hosts and guests are estimated to have injected £3.5 billion into the UK's economy during that time frame (Airbnb, 2018). The rapid ascendancy of short-term lettings, particularly in tourism hotspots such as London, ignites concerns regarding the depletion of long-term rental stock, the escalation of rents, and the detrimental 'hollowing out' of local communities.

The geographical scope and period of the study is dependent on the availability of private rental sector data and Airbnb rental listing data. For the period 2016-2021, this piece of research focuses on evidence drawn from three UK cities: Greater London, Greater Manchester, Bristol. Greater London's global allure as a top-notch destination for business and leisure has secured its position, drawing in an impressive 17 million visitors every year—a vital contribution to its economic and cultural vitality. The city's tourism sector alone enriches its gross value added by £36 billion annually (Smith, 2015). Such financial influx reinforces transnational real estate investment tied to tourism, thus exacerbating an already precarious

housing situation (Shabrina, Arcaute, & Batty, 2021), influenced by a myriad of factors such as an imbalance of housing demand and supply, taxation complexities, and the introduction of international capital. Greater Manchester, known for its vibrant multicultural composition, welcomes around 4 million visitors annually, each adding to the city's cultural and economic fabric. The area is riddled with complexities stemming from varied investment activities, catalysed by tourism and urban revitalisation, and the subsequent proliferation of Airbnb, thereby presenting a unique set of challenges for the housing market and community fabric. Yet, with over 6,500 households classified as in dire need on Manchester's housing register (Yates et al., 2021), the city faces a pressing demand for accessible, affordable housing. Bristol, another favoured destination, radiates a unique charm that draws innumerable visitors, with its local visitor economy surpassing £1.3 billion (VisitBristol, 2023). Despite being less scrutinised, the city distinguishes itself through a robust community ethos, dynamic cultures, and a balanced economy, setting it apart as a special case within the study.

The choice does not imply that these cities are best exemplars, but rather, it reflects the inherent characteristics of the gentrification phenomenon in each case. These cities present a rich set of scenarios in terms of the functioning of the rental market and tourism attractiveness (Hincks, Webb, & Wong, 2014). From London's global stage to Manchester's resurgence and Bristol's distinctive local dynamics, each contribute to a varied and intriguing landscape for exploration. These make them ideal candidates for a comprehensive study that aims to provide nuanced insights into the wider phenomenon of P2P accommodation platforms and their broader societal and economic impacts.

3.4 Data collection

To achieve the purpose of this study, several datasets are collected to build a panel to track P2P accommodation listing and private rental price changes (see also Table A-1). Airbnb is the most widely and frequently used P2P accommodation platform in the market, which can reflect the supply of the short-term rental market. Airbnb's data comes from InsideAirbnb, a third-party open data project that collects and shares data on a monthly basis to help better understand the impact of short-term rentals on the housing market and residential communities, and to provide a basis for quantitative regulation. This dataset contains data on all listings in the major UK cities where Airbnb is used, including their broad host profiles, housing conditions, and location information through which it is possible to acquire detailed information about hosts and rental space, such as prices, coordinates, profile of hosts, room type, bed type, reviews, calendar dates of bookings and requirements for guests. To better match regional house price data, the coordinates of each listing are spatially aggregated by calculating the number of listings and prices in each Lower Output Area (LSOA) for each month. Three

types of accommodations are available on Airbnb: shared room, private room, and entire house/apartment. Data cleaning of duplicate listings and price outliers was carried out, as well as the removal of listings with no review and never update calendars, filtering the housing types according to the aim in different parts of the study, and finally the pooling of a total of 4,768,347 listings to create a database with spatial attributes. In summary, Figure 3-4 reveals that there has been an increasing trend in the number of Airbnb listings in major city regions since 2015. Greater London has the most listings and the most significant growth trend, with close to 20,000 listings at the beginning of 2015 and nearly 90,000 active listings by early 2020, resulting in a significant influx of homes into the P2P accommodation market. Due to the availability of data provided by InsideAirbnb, listings in Greater Manchester and Bristol only started to be collected in 2017, and the number of listings in both is relatively small, but there are between a few thousand and 10,000 listings, with a more modest growth trend. Thus, the three cities have different levels of P2P accommodation development and differ in the fluctuations generated by the impact on the local real estate market.

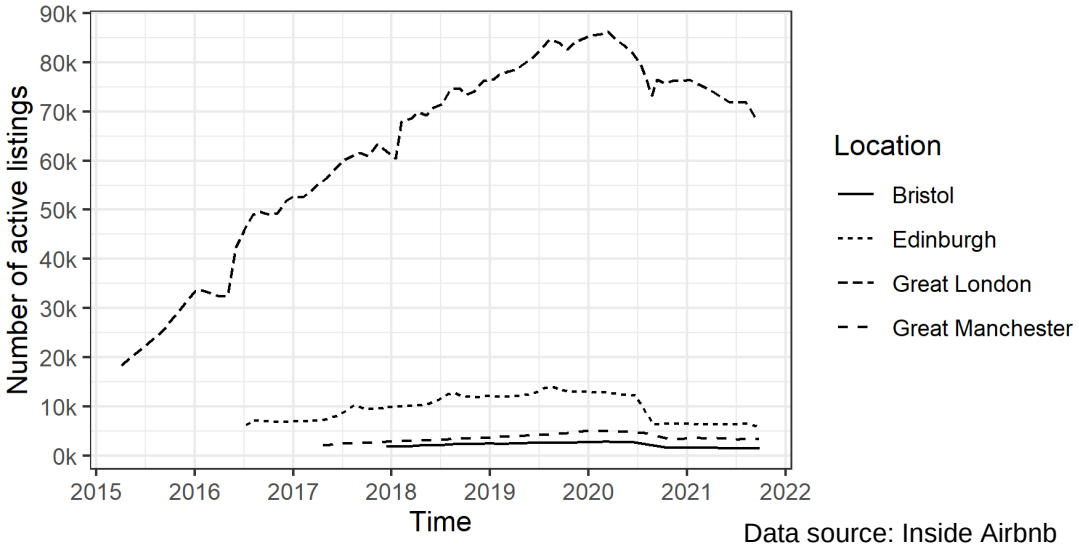


Figure 3-4 Number of active listings in major cities of UK from 2015. (Own elaboration)

Zoopla stands as one of the leading portals among the UK's online real estate search platforms, offering comprehensive insights into UK housing sale price trends, house price valuations and additional information pertinent to home buying and selling information. The site facilitates users to upload details of privately available properties for lease, either independently or via an agent. This data, provided through the ESRC Urban Big Data Research Centre, contains a register of listed sale and rental prices for homes advertised on Zoopla, tracked at various geographic granularities. This offers an in-depth view of the property market across different regions. In this piece of research, the primary application

of this data is the extraction of rental price information and 890,757 listings containing rent price changes have been processed into a time series database. Such information is instrumental in constructing an overview of neighbourhood rental price points within the long-term rental sector. These figures are then compared with those from the short-term rental market, like Airbnb, enabling us to identify trends in the rent gap.

The Output Area Classification (OAC) 2011 is an established typology of dividing British neighbourhoods based on many socio-economic and demographic differences. The OAC divides neighbourhoods into 18 different groups, which represent clusters of neighbourhoods that share some common characteristics but have significant differences from other groups[1]. OAC provides a simple way of examining the characteristics of a neighbourhood, with a holistic view that demonstrates socio-economic and demographic profiles. It can help policymakers and researchers better understand the differences between different neighbourhoods and formulate corresponding policies and measures to improve the economic and social conditions of the communities.

For this examination of the influence that professional P2P accommodation platforms exert on housing prices, transactional records were sourced from the Land Registry Price Paid Data[2] spanning a quarter-century from 1995 to 2019. An exact match of property transactions was undertaken utilising postcodes and addresses, including individual apartment numbers. This pairing process is facilitated by the 'primary addressable object name' (PAON) – indicating a property's number or name – and the 'secondary addressable object name' (SAON) – specifying individual apartment units within a building. Post-matching, the dataset comprised an exhaustive total of 1,643,470 repeat property transactions. Postcodes were subsequently correlated LSOA code to align with Airbnb penetration rates within respective neighbourhoods.

Residential mobility data are held in the Consumer Data Research Centre data collections (CDRC, 2020). This resource consists of estimates of residential mobility in the UK from 1997 to 2020[3]. This is done using a range of administrative and consumer data, including electoral registers, consumer registers and land registry house sales. This data estimates the proportion of households that are different to those in 2020 going back to 1997, so it not only allows researchers to explore changes in neighbourhood residential mobility at small areas, but also to move away from reliance on decennial census data and focus on more recent annual change.

[1] For more details about OAC, please see: https://www.ons.gov.uk/methodology/geography/geographicalproducts/areaclassifications/2011areaclassifications/penportraitsandradialplots

[2] Source: https://www.gov.uk/government/statistical-data-sets/price-paid-data-downloads

[3] Source: https://data.cdrc.ac.uk/dataset/cdrc-residential-mobility-index

With regard to the COVID-19 period-specific Greater London Airbnb dataset, the period from January 2020 until the end of the third lockdown in England was examined, considering three periods that coincide with phases of lockdown and easing of restrictions (see Brown & Kirk-Wade, 2021): January 2020 pre-lockdown, October 2020 first lockdown lifted, and April 2021 post-lockdown, highlighting the extent of the impact on Airbnb in Greater London across these different phases of the pandemic. The Airbnb rentals data was a subset that fell within Greater London over the defined period.

The calculation of monthly revenues for short-term rentals is derived from the product of the nightly price and the number of occupied days in a given month (Yrigoy, 2019). The occupancy estimation is based on the model developed by Inside Airbnb project (see Cox, 2019) and the monthly average revenue for LSOAs was obtained through aggregation of a mean[4]. LSOAs are official census units used in England created for the dissemination of statistical data and are defined by population size (approximately 1,500 people), contiguity and social homogeneity (ONS, 2021). In 2011, the derivation of LSOAs, there were 32,844 LSOAs in England with 4,835 in Greater London.

In addition to housing prices, rents and Airbnb rental information, a range of demographic and socio-economic attributes was compiled at LSOA level from the 2011 Census of Population for England (ONS, 2011), alongside the highly regarded tool, Indices of Multiple Deprivation (IMD, 2019), which could identify potential clusters of deprivation. The IMD serves as an official measure of neighbourhood-level deprivation in England, distinguishing in relative terms, more deprived from less deprived areas. The 2019 English IMD uses indicators from income, employment, health, education, housing, crime, and environment to create weighted domain scores that combine to form a composite deprivation ranking for each LSOA. Besides, the age of residential dwellings was obtained from the House Ages and Prices dataset (CDRC, 2015). Information on open spaces and Public Transport Accessibility Levels were sourced through the London Data Store (Transport for London, 2015). POIs data (Ordnance Survey, 2019) include 10 groups of accommodation, commercial services, attractions, education, sports and transport, with a total of 52 categories[5], through which the various amenities within each LSOA can be calculated.

[4] Our decision to adopt LSOAs as the unit of analysis was driven by uncertainty over the locational coordinates reported in the Airbnb datasets. For reasons of privacy and anonymity, locations are approximated that limits scope to calculate a range of locational attributes, including proximity and distance measures accurately.

[5] More details about groups and categories of POIs, please see Classification scheme (https://www.ordnancesurvey.co.uk/documents/product-support/user-guide/points-of-interest-classification-schemes-v3.4.pdf)

3.5 Methodology

3.5.1 Methods for exploring the spatio-temporal distribution of P2P accommodation

This section will outline the methodology for analysing the spatio-temporal characteristics of Airbnb in the UK. The growth of P2P accommodation is manifested in a varied way in different physical geographies, showing geographical variations due to socio-economic development. These methods aim to measure the temporal trends and spatial growth pattern of P2P accommodation listings, delineate the opening and closing of rent gaps through different measurements and identify the neighbourhood characteristics that are more likely to create rent gaps. By implementing these methods, one can gain a nuanced understanding of how the P2P accommodation sector, specifically Airbnb, has evolved in the UK's housing market and what neighbourhood dynamics there are particularly in relation to the creation and closure of rent gaps.

3.5.1.1 Temporal dynamic characteristics of Airbnb

The methodological approach begins by quantifying temporal trends. To accomplish this, a systematic collection of data will be undertaken, employing zonal statistics. Linear fitting will be applied to illustrate the changes in the overall number of listings within the region. This process will further dissect the data into various types of listings, discerning core-periphery (see Appendix Table A-2 for definition) differences. Over a defined timeframe, this analytical framework aims to elucidate the evolutionary trajectory and proliferation patterns of Airbnb listings in the study regions. In essence, this methodological strategy employs a comprehensive statistical lens to capture the delicate dynamics of temporal trends.

3.5.1.2 The spatial growth pattern of Airbnb

Understanding the spatial growth patterns of short-term rentals is crucial for city planners and policymakers to assess the impact of Airbnb on housing markets and urban development. Dynamic Time Warping (DTW) is a powerful technique for clustering time series data (Senin, 2008), which can be particularly useful for analysing the fluctuation in the number of short-term rental listings. DTW allows for a flexible comparison of time series data, which can account for speed differences in the changes of listing numbers. Because the number of short-term rentals has a high degree of randomness in different seasons, the distance (or similarity) between two time series cannot be effectively found using the traditional Euclidean distance. DTW calculates the optimal match between two time series by warping the time dimension (Müller, 2007). This method involves aligning sequences of data points from different time series to identify patterns

and similarities. The blue lines in Figure 3-5 exemplify how some points are mapped to each other, which shows how they can be warped in time. A distance matrix that represents the dissimilarity between each pair of time series is calculated (Sardá-Espinosa, 2017). The smaller the DTW distance, the more similar the time series are in terms of the pattern of listing number changes.

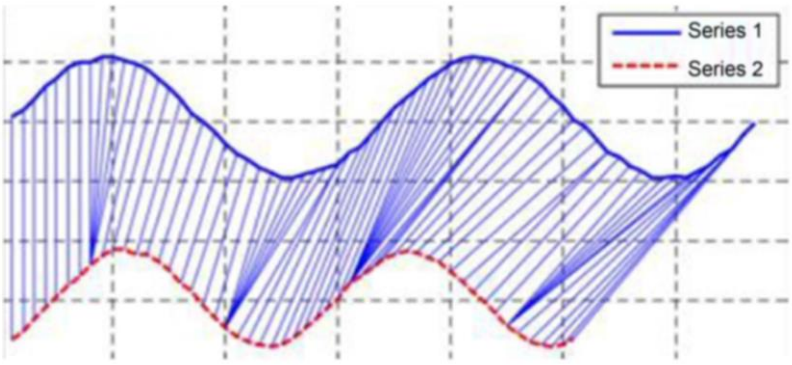


Figure 3-5 Sample alignment performed by the DTW algorithm between two series. (Adapted from Müller, 2007)

To cluster changes in rental listings using DTW, one would commence by compiling monthly time series data of listing counts throughout the study period within the LSOA. DTW would then be applied to measure the similarity between these time series, accommodating variations in timing and frequency of listings by stretching or compressing the time axis of each series to find an optimal alignment between them. The aligned time series can then be clustered based on their DTW distance. Clusters will group listings that show similar trends over time, despite differences in their temporal activity. This methodology provides a robust and flexible approach to understanding the temporal dynamics of short-term rental listings. This could reveal, for example, which neighbourhoods tend to increase in a similar trend.

Finally, a clustering algorithm, the partitioning around medoids (PAM) method (Li, Wu, & Zhang, 2020), is applied to the distance matrix. This groups the time series into clusters based on their DTW distances. The DTW-based PAM clustering method is used to classify the time series growth patterns, and the geographical development trends are summarised into three categories: rapid growth, medium growth and slow growth, based on the change curves of the number of P2P accommodations in each type of geographical area.

3.5.1.3 Rent gap measurement summary

This section delineates the research methods employed to address the research question of measuring the rent gap. Grounded in a comprehensive review and synthesis of rent gap theory, this study concentrates on the dynamics of the rent

gap and its formation mechanism. The objective is to conduct a thorough investigation into the evolution pattern of home-sharing activities within the context of the P2P economy.

Although the rent gap is usually defined as the difference between potential and actual capitalised ground rents, it can be measured in multi-perspective ways when it comes specifically to the issue of P2P accommodation. This study proceeds to provide three major empirical indicators with respect to the distribution and intensity of Airbnb-induced rent gaps on the housing market across the three geographies:

a) *%Potential P2P Revenue* = the proportion of potential P2P rental revenues by total rental revenue (including long-term rentals and P2P rentals) in the neighbourhood. The higher this proportion, the more likely it is that the rent gap is large and attractive for investors to convert long-term rentals into P2P rentals. The findings of Wachsmuth and Weisler (2018) suggest that in areas where this proportion is two standard deviations above the regional mean, the Airbnb-prompted rent gap has been fully opened up with a huge increase in short-term rents and landlords have shifted housing supply into short-term rentals to exploit the rent gap. This indicates that landlords in the region have taken full advantage of Airbnb to move into post-gentrified areas.

b) *%Professional Hosts Revenue* = the median monthly revenue from entire-home listings that are frequently P2P short-term rented as a proportion of the median monthly revenue for private rentals in the neighbourhood. This is a relatively intuitive and concise way of estimating the rent gap. The higher this ratio the more landlords feel able to earn more in the P2P accommodation market. Wachsmuth and Weisler (2018) argue that if this ratio is outlier areas compared to the regional average, there is a significant rent gap between P2P short-term rental and private rental market, and these are where individual landlords earn the most on Airbnb, which is sufficient incentive for landlords to gentrify by using their housing units for P2P rentals.

c) *Revenue Performance* = %Potential P2P Revenue - %Number of P2P Rental listings. It aims to see whether P2P short-term rentals are outperforming long-term ones in the area, and thus whether homeowners can take advantage of an open rent gap by converting their properties. This measure consolidates the existence of rent gap into a single value, without the need to compare the profitability of listed companies and the percentage of revenue generated by them in two different steps (Cansoy, 2018). It can be determined that the rent gap is in a state of being opened up when a neighbourhood receives a significantly higher proportion of its rent revenue through P2P rental than the proportion of number of P2P rentals.

The *%Potential P2P Revenue* indicates at what stage the neighbourhood is in an opening and closing rent gap, and the *%Professional Hosts Revenue* indicates

whether a particular neighbourhood is likely to incentivise landlords to use entire housing units as dedicated P2P rentals. The third indicator combines whether P2P rentals in the area perform better than private rentals, and therefore whether landlords can take advantage of the opening rent gap by switching the use of the property, that is, the vulnerability of the neighbourhood to P2P accommodation induced gentrification. The approach used by Wachsmuth and Weisler (2018) is not faultless because it is difficult to confirm that the rent gap between P2P rentals and private rentals has narrowed when a neighbourhood receives a significantly higher proportion of rental income from P2P rentals than the surrounding area. Better P2P rental revenue encourages greater engagement and profits, but it also leads to lower average rents in the P2P rental market. The *Revenue Performance* measure has a significant advantage because it takes into account not only whether an area is profitable but also the trend of landlords shifting to the P2P rental market, so it is better suited to the character of the multiple cross-sectional data and does not rely on unobserved processes.

To compare the magnitude of the rent gap across different neighbourhoods in the city-region, a classification system based on the number of standard deviations from the mean is adopted. This system divided the neighbourhoods into one of seven categories, according to the rent gap measured by the above indicators over the study period. The thresholds for each category were determined statistically as follow: Far Below ($Rent\ gap < \mu - 2\sigma$), Below ($\mu - 2\sigma \leq Rent\ gap < \mu - \sigma$), Below-to-Average ($\mu - \sigma \leq Rent\ gap < \mu - 0.5\sigma$), Average ($\mu - 0.5\sigma \leq Rent\ gap < \mu + 0.5\sigma$), Average-to-Above ($\mu + 0.5\sigma \leq Rent\ gap < \mu + \sigma$), Above ($\mu + \sigma \leq Rent\ gap < \mu + 2\sigma$), Far Above ($Rent\ gap \geq \mu + 2\sigma$).

The three metrics employed are not intended to be a direct measure of the difference between potential and capitalised land rents, i.e., the rent gap and there is no consensus on what metrics can measure and compare the rent gap. Rather, they simply approach these abstractions as closely as possible given the limited data available, and there are frameworks to support their adequacy in accounting for the rent gap and describe its size, as well as to characterise the risk of gentrification to P2P accommodation. Hammel's (1999b) argument about land rent and scale suggests that capitalised ground rent is largely determined by the extent of the parcel's neighbourhood, while potential ground rent varies according to the size of the city, but the neighbourhood in which the parcel is located within that scale is decisive. It is also needed to acknowledge that tracking price changes before and after changes in the use of individual houses is not feasible. Consequently, all the measures are aggregated to neighbourhood (i.e., MSOA) level (Hincks, 2015).

3.5.2 Methods for identifying the impact of P2P accommodation on house prices

Preceding sections attempt to explain the characteristics of the opening and closing of the Airbnb-induced rent gap and causes that shape their formation in three major cities of the UK, but the association between P2P rental and house prices remains uncertain. In an attempt to explore the link between P2P rental and house prices, an econometric framework will be used to examine associations between P2P rental, housing availability and affordability. When it comes to the impact of P2P accommodation (listed on the Airbnb platform for more than 6 months a year) on neighbourhood house prices, a repeat sales model design is mainly adopted to control for property-specific fixed effects, thereby mitigating the risk of omitted variable bias.

3.5.2.1 Modelling the impact of Airbnb on housing prices

It is assumed that Airbnb's emergence may correlate with an upswing in rental prices, precipitated by the withdrawal of properties from the long-term real estate market in favour of short-term holiday leasing. To scrutinise this hypothesis concerning the fluctuation in price changes arising from Airbnb's impact on housing supply, housing transaction data spanning from 1995 to 2019 have been meticulously collected, both pre and post Airbnb's emergence, in three key regions: Greater London, Greater Manchester, and Bristol. These data were analysed in three progressive phases.

- Phase 1: Establishing a Baseline Model

The initial approach utilised a straightforward ordinary least squares regression to establish a repeat sales model, serving as a baseline. By analysing housing transaction records, an attempt was made to discern the relationship between changes in property prices at different time points and the proportion of Airbnb listings within the neighbourhood. This phase allowed us to gain a comprehensive understanding of the fundamental patterns and trends governing price fluctuations in the housing market. The ordinary repeat sales model formulated below is a variation of the hedonic approach (Case et al., 2006). Differencing the hedonic price model yields the classical repeat sales model. Given that significant physical and locational changes are unlikely to occur between two transactions for samples involved in multiple transactions, it may be unnecessary to observe real estate characteristic variables in the context of the repeat sales model. To elaborate, the repeat sales model initially computes the difference between the prices of any two transactions for each housing sample (commonly in logarithmic form) (Leishman & Watkins, 2017). Subsequently, a regression is performed on these differences against time dummy variables. Finally, the housing price index is computed using the coefficients of the time dummy variables. The specific form of the model is expressed as in Equation (1):

$$\ln P_t - \ln P_s = \sum_{j=1}^{T} \beta_j D_j \ + \varepsilon_{t,s} \quad (1)$$

Here, P represents the transaction price of the sample, s and t denote the times of the two transactions, $\varepsilon_{t,s}$ is the random errors, and the values of D_j satisfy Equation (2).

$$D_j = \begin{cases} 1, j = t \\ -1, j = s \\ 0, j \neq t, j \neq s \end{cases} \quad (2)$$

The sequence of coefficients β, obtained by estimating the above equation, is the fixed effects of the time dummies in the house price.

The hedonic price model and the repeat sales model are mathematically identical in nature. Of course, the consistency of the two models is also subject to the prerequisite that the sample selection is random. In practice, long time series data were chosen to obtain more matching samples of multiple transactions, to avoid the sample selection bias.

- Phase 2: Incorporating External Factors

Subsequently, expanded upon the standard model, external features that underwent changes between two transaction periods are introduced. Notably, the encroachment of Airbnb listings, occurring in the neighbourhoods where housing transactions took place, is integrated into the model. This augmentation resulted in a hybrid repeat sales model, which included the neighbourhood's Airbnb penetration rate as an explanatory variable, along with other control variables that could potentially influence property price changes. This method was deemed superior to cross-sectional data approaches, as it effectively mitigated the influence of property-specific attributes on price variations (Leishman & Watkins, 2017), allowing for a more precise measurement of the marginal effects of external factors on price changes.

Upon the baseline model, the estimation of the hybrid repeat sales model further controls change variables between two transactions, elucidating the temporal variations in housing prices. The specific form of the equation based on Equations (1) and (2) are demonstrated in Equation (3):

$$\ln P_t - \ln P_s = \beta_1 STR_t + \sum_{i=1}^{m} \beta_i \left(X_{i,t} - X_{i,s}\right) + \sum_{j=1}^{T} \beta_j D_j + \varepsilon_{t,s} \quad (3)$$

In the formula of the hybrid model, STR_t represents the proportion of Airbnb rentals in the neighbourhood at time t as the primary external explanatory variable. $X_{i,t} - X_{i,s}$ denote the factor i that have undergone changes between transaction time t and transaction time s for the property, where the number of days between two transactions and the age of the dwelling are included into the model, as these factors can influence house values over time or as the property

ages. The meanings of other parameters remain consistent with Equations (1) and (2).

- Phase 3: Multilevel Modelling

In the final phase, that is Chapter 8, a multilevel model is applied (Peugh, 2010; Deboosere et al., 2019), categorising each neighbourhood as a level, to re-estimate the hybrid repeat sales model. This advanced model further considered neighbourhood heterogeneity, thereby exploring the extent to which Airbnb may alter the growth patterns of housing market prices at the neighbourhood level within UK cities. It considered the question of whether different neighbourhoods exhibit varying price responses to changes in the proportion of long-term operating Airbnb properties. This model retained the same variable configuration as the hybrid repeat sales model but introduced random intercepts and random slopes for Airbnb proportions to capture these disparities. Based on the research considerations of the study, the following model is constructed:

Property level:

$$\ln P_t - \ln P_s = \beta_{0k} + \beta_{1k} STR_t + \sum_{i=1}^{m} \beta_i \left(X_{i,t} - X_{i,s}\right) + \sum_{j=1}^{T} \beta_j D_j + \varepsilon_{t,s} \quad (4)$$

Neighbourhood level:

$$\beta_{0k} = \lambda_{00} + \delta_{0k};\ \beta_{1k} = \lambda_{10} + \delta_{1k} \quad (5)$$

In the equation (4), β_{0k} and β_{1k} are the intercepts and the coefficients for STR_t at the property level. In the equation (5), λ_{00} is the mean of the regression intercepts in the neighbourhood level and δ_{0k} is the random effects of the regression intercepts in the neighbourhood k. λ_{10} is the mean of the regression coefficients for STR_t in the neighbourhood level and δ_{1k} is the random effects of the regression coefficients in the neighbourhood k.

3.5.2.2 Pen portraits for gentrification types and neighbourhood churn

The growth of P2P accommodation is understood to have increased the pressure on housing affordability and additional gentrification in some neighbourhoods, and these associations may differ due to residential mobility across neighbourhoods, so it is necessary to also explore the association of the P2P accommodation on gentrification and neighbourhood churn. This involves examining the link between the risk of P2P-accommodation-induced gentrification and potential residential displacement, especially in deprived neighbourhoods.

Gentrification typologies can be useful a conceptual tool for simplifying complex urban dynamics into distinct types and enable comparative analysis across different cities (Robson, Lymperopoulou, & Rae, 2008; Zhang et al., 2020). To designate neighbourhoods by their type of change, the standard deviation method is adopted to classify neighbourhoods according to the degree of the impact exerted by Airbnb properties (see Table 3-1). Given the extent of variation or dispersion in Airbnb impacts, seven distinct gentrification neighbourhood types

were identified. Each type exhibits distinct characteristics and trajectories of socio-spatial change, representing a progression along the gentrification spectrum. This approach cannot show that the house price change is destined to be directly related to neighbourhood gentrification, but it could lead to reflections on the relationship between neighbourhoods suffering from P2P accommodation penetration, residential mobility and housing affordability, and this linkage may help to create an early warning system for gentrification. To further deepen the understanding of potential displacement, a typology of neighbourhoods is outlined according to the proportion of households that are different to those in 2020 going back to 2011 with the CDRC's population churn dataset (CDRC, 2020) which produces annual estimates of population churn at the LSOA level. By implementing this classification, a nuanced and evidence-based typology of population churn at the LSOA level can be derived, offering valuable insights in understanding population dynamics in specific geographic areas. Succinct pen portraits of each area type are provided below to elucidate the key characteristics.

Table 3-1 Dimensions of gentrification typology and neighbourhood churn degrees. (Own elaboration)

Type	Description
(a) Gentrification typology	
Highly disrupted	A highly disrupted area is one where the impact of long-term occupied Airbnb properties on neighbourhood housing prices is negative and well below 4 standard deviations of the three cities' average. Airbnb penetration has radiated significant negative externalities onto the surrounding environment and exerted a substantially detrimental impact on the housing prices in the neighbourhood. The area's population is at risk of decline due to the insecurity caused by frequent home-sharing, resulting in the displacement of original residents.
Disrupted	A disrupted area is one where the impact of long-term occupied Airbnb properties on neighbourhood housing prices is negative and below 2-4 standard deviations of the three cities' average. Airbnb penetration has generated negative externalities onto the surrounding environment and produced a detrimental impact on the housing prices in the neighbourhood. The neighbourhood has been churned up due to short-term rentals.
At risk of disruption	An area at risk of disruption means that the impact of long-term occupied long-term occupied Airbnb properties on neighbourhood housing prices is weak or unintended and below 1-2 standard deviations of the three cities' average. Airbnb penetration has generated negligible or slightly negative externalities onto the surrounding environment and produced a subtle impact on the housing prices in the neighbourhood. The neighbourhood may be potentially infested with P2P short-term rentals.
Moderate	A moderate area is one where the premium of all long-term occupied Airbnb properties on neighbourhood housing prices is low and between -1 and 1 standard deviation of the three cities' average. Airbnb penetration has generated marginally positive externalities onto the surrounding environment and brought about a mild appreciation on the housing prices in the neighbourhood. The impact of long-term operating Airbnb on house prices is within normal range.
At risk of gentrification	An area at risk of disruption means that long-term occupied Airbnb properties have an impact on neighbourhood housing prices, and it is above 1-2 standard deviations of the three cities' average. Airbnb penetration has generated slightly positive externalities onto the surrounding environment and potentially put pressure on housing costs and may increase the housing burden on low-income communities.
Gentrified	A gentrified area is defined as an area where the impact of long-term occupied Airbnb properties on neighbourhood housing prices is positive and above 2-4 standard

	deviations of the three cities' average. Airbnb penetration has taken some housing resources and have generated economic externalities onto the neighbourhood. Housing prices in the neighbourhood has been raised due to short-term rentals and low-income residents get increased economic pressure.
Highly gentrified	The type of highly gentrified area is one where the long-term occupied Airbnb properties have a considerable premium on neighbourhood housing prices and the impact is well above 4 standard deviations of the three cities' average. Airbnb penetration has seriously destabilised the local housing market and housing prices have risen beyond expectations. The surge in housing prices caused by Airbnb has made it increasingly challenging for low-income households to afford living in the neighbourhood.
(b) Neighbourhood churn	
Low churn	A low churn neighbourhood is one where the household change rate is below 2-4 standard deviations of the three cities' average. It is characterised by a high degree of residential stability, with over 87% of households residing at the same address for over nine years. This low resident turnover rate results in an entrenched sense of community and continuity with minimal disruption from new business.
Moderate-to-low	A moderate-to-low churn neighbourhood is one where the household change rate is below 1-2 standard deviations of the three cities' average. It experienced a fair degree of residential stability while still absorbing some household turnover. Approximately 78-87% of households have remained at the same address for over nine years. Residents maintain neighbourhood continuity while accepting gradual change. New changes proceed slowly enough for existing residents to acclimate.
Moderate	A moderate churn neighbourhood is one where the household change rate is between -1-1 standard deviations of the three cities' average. Between 58-78% of households have remained within the same address over a nine-year period. Moderate churn neighbourhoods experienced a substantial degree of household turnover and residential mobility. Change happens unevenly, disrupting social fabrics and, in some instances, leads to the displacement of certain residents. Housing includes a fluid mix of new renters and owners. While exhibiting flux, a steadfast core of long-term residents remains.
Moderate-to-high	A moderate-to-high churn neighbourhood is one where the household change rate is above 1-2 standard deviations of the three cities' average. Moderate-to-high churn neighbourhoods experienced a noteworthy degree of household turnover and residential mobility, with 41-50% of households having moved within the nine years. Moderate-to-high churn areas exhibit stark divisions between the influx of new arrivals and the few remaining long-term residents. Traditionally established communities have undergone significant transformation or dissolution.
High churn	A high churn neighbourhood is one where the household change rate is above 2-4 standard deviations of the three cities' average. High churn neighbourhoods exhibit considerable household turnover and residential transience, with 50-69% of households moving away within the nine-year span. Long-term homeowners are sparse, and only a handful persist from the pre churn era. These high churn localities have transformed into transient hubs for new entrants to the city seeking short-term lodging. Students, young professionals, and short-term immigrant renters characterise the high inflows.
Extreme churn	An extreme churn neighbourhood is one where the household change rate is above 4 standard deviations of the three cities' average. Extreme churn neighbourhoods exhibit unprecedented levels of household turnover. There is an unparalleled level of household turnover, with over 69% of households relocating or experiencing displacement within a nine-year timeframe. These localities underwent a profound metamorphosis, becoming transient hubs where global second-home buyers perpetually flow in and out. The privatisation of assets for profit amid this perpetual churn is a prevailing trend, contributing to a comprehensive transformation of the area.

3.5.3 Methods for investigating peer-to-peer accommodation market responses during COVID-19 pandemic

This section details the geospatial framework utilised to investigate the spatial and temporal dynamics of short-term Airbnb rentals in response to the COVID-19 crisis. It focuses on market trends and changes in Airbnb host revenue for all active Airbnb listings during the pandemic. Spatial regression models will be used to analyse fluctuations in neighbourhood Airbnb revenue, as well as the determinants influencing these changes, controlling for spatial autocorrelation. Three study phases, pre-lockdown, after the first lockdown, and the post-lockdown period are selected, when all P2P accommodations were allowed to operate, in order to better compare the changes in the Airbnb market over time and to avoid that the lockdown measure affects the observation of the market. For Airbnb revenue not explained by the regression model, we pay special attention to their spatial agglomeration correlation with neighbourhood deprivation.

3.5.3.1 Spatial regression models

Having developed the dataset of Airbnb listings, attributes and neighbourhood characteristics, the next step involved calculating descriptive statistics of Airbnb listings across 'sub-regions' of Greater London. Next, the modelling framework was specified to capture temporal and spatial patterns of Airbnb listings in Greater London over the different pandemic periods, reflecting locational effects on revenues. At the starting point, ordinary least squares (OLS) regression models were used to estimate global trends and relationships between the dependent and independent variables for Greater London. However, analysis revealed the presence of spatial autocorrelation in Airbnb listings at all three time periods. Given that the global OLS models assume uniform relationships between the dependent and each explanatory variable, it is unable to account for local variations in regression coefficients and goodness-of-fit. Therefore, two alternative approaches — spatial lagged models (SLM) and spatial error models (SEM) — were employed to supplement the global OLS model as a means of accounting for spatial dependence by using the same dependent and independent variables employed in the OLS model.

SLM focuses on the existence of diffusion of variables in a region (i.e., spatial spillover effects) by adding a spatial lag term for the dependent variable to the OLS model, which takes into account the effect of observations of the dependent variable in one spatial unit X_i $(i = 1, 2, \ldots, \mathrm{n})$ by observations in its neighbourhoods $X_j (j \neq i)$

$$Y = \rho WY + X_i\beta_i + \varepsilon_i \quad (6)$$

Where Y is the dependent variable; X_i is the ith independent variable; W is the spatial weight matrix; ε_i is the random error term; ρ is the spatial lag coefficient, which reflects the degree of explanation of the dependent variable by the spatial neighbourhood unit; and β_i reflects the effect of the ith independent variable X_i on the dependent variable Y.

SEM deals with the presence of spatial dependence of the error term focusing on the spatial dependence caused by omitted variables. The model incorporates a spatially lagged error term in a classical linear regression. A common spatial error model expression is:

$$Y = X_i\beta_i + \varepsilon, \varepsilon = \lambda W\varepsilon + \mu \quad (7)$$

Where λ is the autoregressive parameter, measuring the role of spatial dependence in the error term; $W\varepsilon$ is the spatial error, and ε and μ are both random error vectors.

The spatial model setting typically consists of two main steps:

1. Calculating the spatial weight matrix to quantify the spatial dependence between observations. After testing, a Gaussian kernel with adaptive bandwidth matrix was adopted.
2. Model comparison and selection. The choice of model (Seya, Yoshida, & Yamagata, 2020; Anselin, 1988) for SLM and SEM is decided by evaluating the Lagrange multiplier (LMLAG and LMERR) and their robustness measures (R-LMLAG and R-LMERR).

3.5.3.2 Influence factors of neighbourhood Airbnb revenue

Research has shown that the locating and survival of Airbnb listing is closely associated with neighbourhood characteristics (Shi et al., 2021). Taking LSOAs as the basic study unit, OLS, SLM and SEM models are applied to examine the geographical association between Airbnb revenue and neighbourhood externalities, specifically structure, amenities, location, transport and socio-demographics over three lockdown phases (Table 3-2). Structural factors are understood to be important determinants of short-term rental attractiveness, with newer buildings and greener areas being more desirable to potential guests (Shan, He, & Wan, 2023). Amenities are often-cited as sources that boost or limit Airbnb revenues, with higher density of attractions being associated with increased revenue generation, and diverse leisure and shopping venues enhancing the guest experience and making the location more attractive (Shabrina, Buyuklieva, & Ng, 2020; Eugenio-Martin, Cazorla-Artiles, & González-Martel, 2019). The distance from the city centre and public transport accessibility broadly reflects the potential ground rent of the site location within the area, influencing house prices (Garcia-López et al., 2020; D'Acci, 2019) and P2P short-term rental revenues (Jiao & Bai, 2020), while certain sociodemographic factors have been shown to be more often associated with participation in the supply of P2P short-term rentals and home sharing activities (Jiao and Bai, 2020; Morales-Pérez et al., 2020; Tang et al., 2019).

Table 3-2 Description of variables.

	Variables	Time	Description
Dependent variables (Jan. 2020 - Apr. 2021)	Pre_avg_rev_cal	Jan. 2020 - Apr. 2021	Average Airbnb listings revenue per bedroom (£) within the LSOA unit at the time of the pre-lockdown (Yrigoy, 2019). [a]
	Fst_avg_rev_cal	Jan. 2020 - Apr. 2021	Average Airbnb listings revenue per bedroom (£) within the LSOA unit at the time of the first lockdown lifted. [a]
	Post_avg_rev_cal	Jan. 2020 - Apr. 2021	Average Airbnb listings revenue per bedroom (£) within the LSOA unit at the time of the post-lockdown. [a]
Explaining variables			
Structural factors	Dwe_ModAge	2021	Dwelling modal built-up year of the LSOA unit (Shan, He, & Wan, 2023). [d]
	OpenSpace_Pct	2014	Percentage of households within the LSOA unit with good access to public open spaces (Quattrone et al., 2016). [e]
Amenities	Tour_Den	Nov. 2019	Density of tourist attractions (number/km^2) within the LSOA unit (Sun, Wang, & Hu, 2022). [b]
	Leisure_Den	Nov. 2019	Density of bars and pubs (number/km^2) within the LSOA unit (Jiao & Bai, 2020; Xu et al., 2020). [b]
	Shop_Den	Nov. 2019	Density of shopping centres and retail parks (number/km^2) within the LSOA unit (Ayouba et al., 2020). [b]
Location and transportation	PTALs	Nov. 2019	Average score of public transport accessibility levels in the LSOA unit (Quattrone et al., 2016). [c]
	N_PT	Nov. 2019	Number of bus and tram stops within the LSOA unit (Morales-Pérez, Garay, & Wilson, 2020). [b]
	Dist_CBD	Nov. 2019	Distance (m) of the LSOA unit from the city centre (Jiao & Bai, 2020). [b]
Socio-demographics	Pop_Den	2011	Population density (number/km^2) in the LSOA unit (Jiao & Bai, 2020). [c]
	Ethnic_Pct	2011	Percentage of non-white population (%) in the LSOA unit (Morales-Pérez, Garay, & Wilson, 2020). [c]
	No_Resi_Pct	2011	Percentage of household spaces with no usual residents (%) in the LSOA unit (Barron, Kung, & Proserpio, 2020). [c]
	PriRental_Pct	2011	Percentage of private rented household spaces (%) in the LSOA unit (Quattrone et al., 2018). [c]
	Homeworker_Pct	2011	Percentage of people mainly work at or from home (%) in the LSOA unit (Ma et al., 2021). [c]
	Unemploy_Pct	2011	Percentage of people unemployed (%) in the LSOA unit (Ayouba et al., 2020). [c]
	Qual_Pct	2011	Percentage of people with higher education qualification (%) in the LSOA unit (Morales-Pérez, Garay, & Wilson, 2020). [c]
	Mean_Income	2011	The average income level (£) in the LSOA unit (Moreno-Izquierdo et al., 2020). [c]

Sources: [a] Airbnb listings (https://insideairbnb.com).
[b] Points of interest are collected from EDINA Digimap (https://digimap.edina.ac.uk/os).
[c] PTALs and Census 2011 are collected from London data store LSOA Atlas (https://data.london.gov.uk/dataset/lsoa-atlas).
[d] Dwe_ModAge is collected from Consumer Data Research Centre (https://data.cdrc.ac.uk/dataset/dwelling-ages-and-prices/resource/dwelling-age-band-counts-lsoa-2021).
[e] OpenSpace_Pct is compiled by GiGL and collected from London data store (https://data.london.gov.uk/dataset/access-public-open-space-and-nature-ward).

3.6 Conclusion

This chapter has constructed the conceptual framework, and introduced the research design and methodologies employed to address the objectives outlined in subsequent analytical chapters.

The initial section of this chapter establishes the conceptual framework to guide the study of P2P accommodation induced gentrification. The development of this framework stemmed from the imperative need to address the lack of systematic approaches in conceptualising P2P accommodation as a significant factor with distinct spatial arrangements, inducing gentrification without redevelopment. The framework serves to elucidate the capital sources of potential and actual ground rent. The formation of the rent gap is intricately connected to external conditions, wherein both traditional and P2P rental income derive benefits from spillover effects of external investments and services, particularly in capitalising on community public goods. In the ongoing process of widening the rent gap, there is an inherent correlation with the transition from amateur to professional supplies in the P2P accommodation market. This conceptual framework also articulates the geographical manifestation of the rent gap. Geographically, the expansion of the rent gap is concentrated in two distinct community types: established areas surrounding central business districts with a high prevalence of short-term tourist accommodation, and culturally identified residential areas with leisure facilities and good public transport networks. Drawing on existing research, this framework provided a comprehensive yet systematic guide for research and a deeper understanding of this evolving form of gentrification.

The following section of this chapter elucidates the rationale behind the selection of the study area, data sources, and the research methodology employed. This serves to complement the previously established conceptual framework. This chapter addresses the intersection of P2P accommodation and the housing market, a topic often explored in the context of US and mainland European cities, with limited attention given to UK cities in existing literature. To bridge this gap, the study focuses on three diverse UK cities. The research relies almost exclusively on secondary data sources. While the advantages of secondary data are evident, it is crucial to acknowledge and navigate the inherent challenges and the necessity for

data cleaning associated with such sources, as thoroughly explored in the study. Lastly, the research methodology is expounded upon, specifically the exploration techniques for the spatio-temporal distribution of P2P accommodation, the three-stage design for assessing the impact of P2P accommodation on house prices, and the spatial methods for examining market responses during the COVID-19 pandemic. These methodological insights set the stage for the forthcoming empirical chapters, providing a comprehensive understanding of the research design.

CHAPTER 4
LOCATING AIRBNB IN THE CITY

4.1 Introduction

In the last decade, the rise of the sharing economy has reshaped the urban accommodation landscape. Among the companies leading this change, Airbnb has become a global phenomenon (Puschmann & Alt, 2016). Airbnb has taken root in 81,000 cities across the globe and has a fairly wide coverage. On a global scale, the major markets are in the United States, France, Italy, Spain, and the United Kingdom (Crommelin et al., 2018; Gurran, 2018; Acs et al., 2021). Overall, cities within the U.S. are viewed as significant contributors to Airbnb's revenue, with New York City standing out as the most crucial (Gunter, Önder, & Zekan, 2020). As Airbnb's listings integrate into the fabric of cities, they cultivate a distinct spatial distribution pattern which has significant implications on neighbourhoods and the local housing markets, and urban form.

The spatial distribution of Airbnb listings in a city depends on various factors, such as the availability of housing, the attractiveness of different neighbourhoods, the accessibility of public transportation, and the regulations imposed by local authorities (Eugenio-Martin, Cazorla-Artiles, & González-Martel, 2019; Sun, Wang, & Hu, 2022). Generally, Airbnb listings tend to cluster in central areas that have high tourist demand, cultural amenities, and diverse services (Gutiérrez et al., 2017; Törnberg, 2022a). However, some peripheral areas may also have high concentrations of Airbnb listings if they offer lower prices, more space, or specific attractions (Domènech & Zoğal, 2020).

Airbnb's infiltration into the city has been transformative, particularly impacting residential forms. Utilising Airbnb for holiday rentals not only impacts the hospitality industry but also affects residential neighbourhoods in both positive (e.g., enhance the diversity and vitality of urban spaces, better sources allocation and idle house reuse) and negative ways (e.g., occupying housing and rental units) (Ioannides, Röslmaier, & van der Zee, 2019).

It also changed the ecology of tourism zones. while giving tourists authentic and 'off-the-beaten-track' experiences of staying with locals (Gutiérrez et al., 2017), The platform's influence also extends to tourism gentrification and cultural displacement around certain tourist attractions, neighbourhoods cater to tourism-related business.

The intrusive penetration of short-term rentals has influenced daily life in cities. Complaints about rising rents, neighbourhood changes, and disturbances

are common (Oskam & Boswijk, 2016; Espinosa, 2016); for example, regarding the liveability and housing affordability in Barcelona (Garcia-López et al., 2020) and Berlin (Füller & Michel, 2014). Urban holiday rentals may exacerbate competition for roadside parking, boorish and noisy behaviour at odd hours by out-of-town guests, and other disruptions to a formerly all-residential area. In extreme cases, it can be envisaged that they might disrupt the overall character of a neighbourhood primarily inhabited by permanent residents.

The platform operates in a grey area of regulation, often benefiting from the tech industry's freedom from stringent rules (Prior, 2017). As described above, the disruptive effects of Airbnb on local communities have led to calls for more robust regulation. how to regulate short-term rentals to mitigate negative impacts while still reaping the potential benefits of the sharing economy, many cities around the world have several intense debates and political struggles for regulatory challenges (Wegmann & Jiao, 2017; Colomb & Moreira de Souza, 2023). The challenge of integrating this new model into their existing regulatory frameworks is obvious. International approaches vary widely, from permissive policies that encourage the growth of short-term rentals to stringent regulations aiming to curb their impact on local housing markets. Critics also argue that these short-term leases are mostly operated illegally in many cities as landlords may not be able to meet their tax obligations (Guttentag, 2015; Palombo, 2015).

This chapter aims to locate Airbnb in the city and unpacks the complex relationship Airbnb has with cities, the spatial patterns of its listings across different cities, the impact of Airbnb on reshaping the city, the regulatory challenges and responses of local authorities, and the service's implication on urban spaces.

4.2 Trends in Airbnb listings

In the last decade, Airbnb has rapidly grown from a simple, online bed and breakfast operation to a leading global hospitality service provider. The proliferation of Airbnb listings varies across global cities, reflecting the platform's adaptability to diverse urban environments. A consistent upward trend in the number of Airbnb listings, showcasing the platform's widespread adoption. US cities like Los Angeles, San Diego, and New York, European cities like London, Paris, Madrid and Asian cities Istanbul, Dubai, Tokyo, Seoul have a large market size, with over 10,000 Airbnb units available (Spirou, 2011; Roelofsen & Minca, 2018). It's worth taking a look at developments of Airbnb in global cities.

Founded in San Francisco, Airbnb has evolved into one of the city's most popular online short-term rental platforms. As of 2023, there are over 7,800 active listings on San Francisco Airbnb, reflecting high demand for accommodations driven by business, entrepreneurship, or conference-related visits. The majority of San Francisco Airbnb listings offer entire homes or apartments, constituting 65%

of the total, followed by private rooms at 33%, with shared spaces making up a minimal 1% (Inside Airbnb, 2020). In 2018, the average nightly rates for Airbnb rentals in San Francisco were approximately £136 (entire homes) and £85 (private rooms). The city's diverse and vibrant neighbourhoods, from the trendy Mission District to the historically rich North Beach area, provide a myriad of accommodation options catering to different preferences and budgets. Similarly, Airbnb's footprint in New York City has witnessed significant expansion, surging from a modest start of 150 active listings in January 2010 to over 42,000 by October 2020 (Inside Airbnb, 2020). The most popular Airbnb hosting communities include Manhattan (44.3%), Brooklyn (41.2%), Queens (11.6%), the Bronx (2.3%), and Staten Island (0.6%). The trajectory of Airbnb's development in New York City mirrors a rapid and diversified narrative, echoing shifts in traveller preferences towards personalised and localised experiences.

Greater London: The landscape of Airbnb in Greater London was also remarkable over the past decade (Figure 4-1). Between 2010 and 2020, the number of Airbnb listings in the city has increased by 383% from 18,436 in 2015 to the peak of 87,235 in 2020. The most popular boroughs for Airbnb listings were Westminster (11.2%), Tower Hamlets (8.1%), Hackney (7.5%), Camden (6.8%) and Kensington and Chelsea (6.7%).

The majority of Airbnb listings in Greater London are entire homes or apartments, followed by private rooms and shared rooms. As of July 2020, there were 11,927 private rooms, 475 shared rooms, and 57,598 entire homes or apartments listed on Airbnb in Greater London. Even houseboats, narrowboats and studios have entered the fray. Guests can thus choose between modern flats, Victorian townhouses, houseboats on the Thames and more. This caters from classic tourists to those chasing quirky stays beyond prototypical hotel rooms.

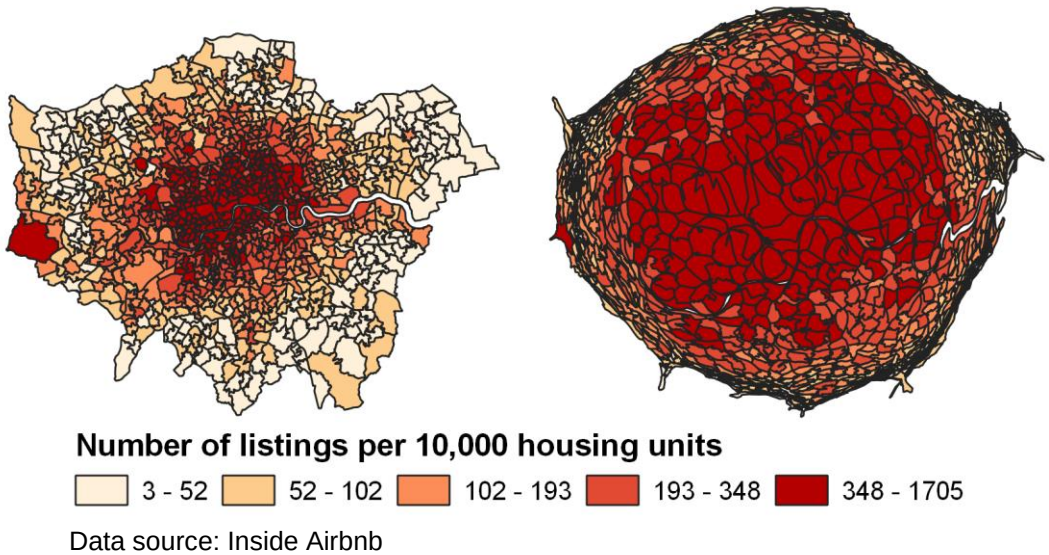


Figure 4-1 Airbnb listing distribution (left) and diffused cartograms showing reshaped cities by the concentration of Airbnb listings in neighbourhoods (right) in Greater London, 2023. (Own elaboration)

The nightly price of Airbnb listings in Greater London varies by the type of accommodation. As of July 2020, properties with four or more bedrooms had the highest nightly price of £335. The nightly price for entire homes or apartments was £192 while the nightly price for private rooms was £66 and shared rooms had the lowest nightly price of £45. This pricing structure reflects the diverse preferences and budgets of Airbnb users in Greater London.

The lowest occupancy rate, recorded at 30% in the lowest months of 2021, indicates a degree of seasonality and fluctuation in demand. In contrast, the month of September stands out with the highest occupancy rate, reaching 53%. This peak aligns with the broader tourism patterns, suggesting a heightened demand for short-term rentals during this period.

In short, Airbnb has experienced significant growth in London over the past decade. The supply and demand of Airbnb listings in Greater London depend on various factors such as the type, size, location, and price of the accommodation. Airbnb listings are concentrated in the central and eastern parts of the city, especially in Westminster, Tower Hamlets, Hackney, Camden, and Kensington and Chelsea. These areas are close to popular tourist attractions, cultural venues, and business districts. Airbnb listings are scarce in the outer and southern parts of the city, especially in Sutton, Bexley, Havering, and Bromley. These areas are more residential, suburban, and distant from the city centre. The platform offers a variety of accommodation options for travellers, but also raises concerns about its commercialised impact on the local housing market and communities.

Greater Manchester: The number of Airbnb listings in Greater Manchester grew in the years leading up to 2020. There were approximately 2,500 active listings across the city in 2015. By 2020, that number had doubled to over 5,000 listings. The central neighbourhoods of Manchester city centre and Deansgate saw some of the biggest increases (Figure 4-2), with their listings quadrupling over those five years. Even more striking was the nearly 400% increase in listings for entire properties during the same period. On average, 263 entire properties were added each year.

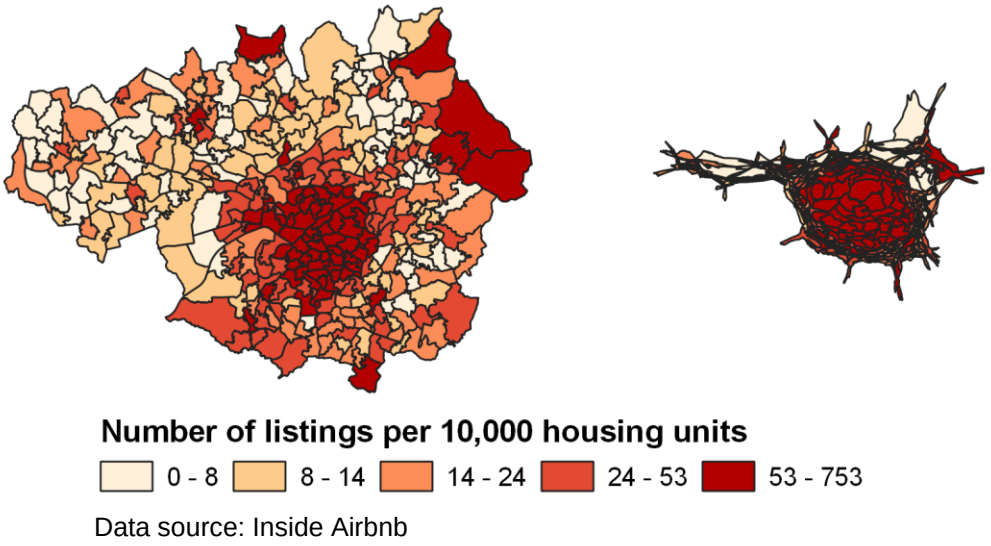


Figure 4-2 Airbnb listing distribution (left) and diffused cartograms showing reshaped cities by the concentration of Airbnb listings in neighbourhoods (right) in Greater Manchester, 2023. (Own elaboration)

The types of listings catered to a variety of travellers. Entire homes made up the majority at around 60%, while private rooms accounted for 30% and shared or hotel rooms the remaining 10%. One-bedroom flats or houses were the most common property type, representing 45% of listings. However, larger family homes with 2-3 bedrooms also saw strong growth as Airbnb appealed more to vacationing families. Listing prices varied widely depending on location, amenities, and size of the accommodation. In 2018, average nightly rates were approximately £100 for an entire home and £60 for a private room. Manchester city centre commanded the highest prices, often over £150 per night. The most popular areas for Airbnb listings in Greater Manchester are the city centre, Salford Quays, and the Northern Quarter. These areas are all home to a large number of attractions, including museums, art galleries, and restaurants. They are also well-connected by public transport, making them ideal for visitors to the city.

Holiday rental activity also spiked over holiday periods like Christmas, New Year's, and summer breaks. Seasonal changes in prices often followed occupancy rate trends, with listed properties able to charge premium rates when demand was at its peak. International travellers, especially from European countries, comprised a significant portion of guests pre-2020. Domestic visitors from other parts of the UK also contributed to Greater Manchester's growing short-term rental market on Airbnb.

Bristol: The rise of Airbnb listings in Bristol over the past few years has been a significant development. In 2020, the city saw over 2,810 listings, a figure that has been steadily increasing (Figure 4-3). This surge in listings can be attributed to several factors, not least of which is the city's burgeoning tourism industry, but

Bristol's relatively low cost of living compared to other major UK cities has made it an attractive destination for hosts and guests alike.

The types of listings available cater to a diverse range of travellers. Entire homes made up the majority at around 53%, while private rooms accounted for 43% and hotel rooms plus shared rooms the remaining 4%. One-bedroom flats or houses were the most common property type, representing 62% of listings. However, larger family homes with 2-3 bedrooms also saw strong growth as Airbnb appealed more to vacationing families.

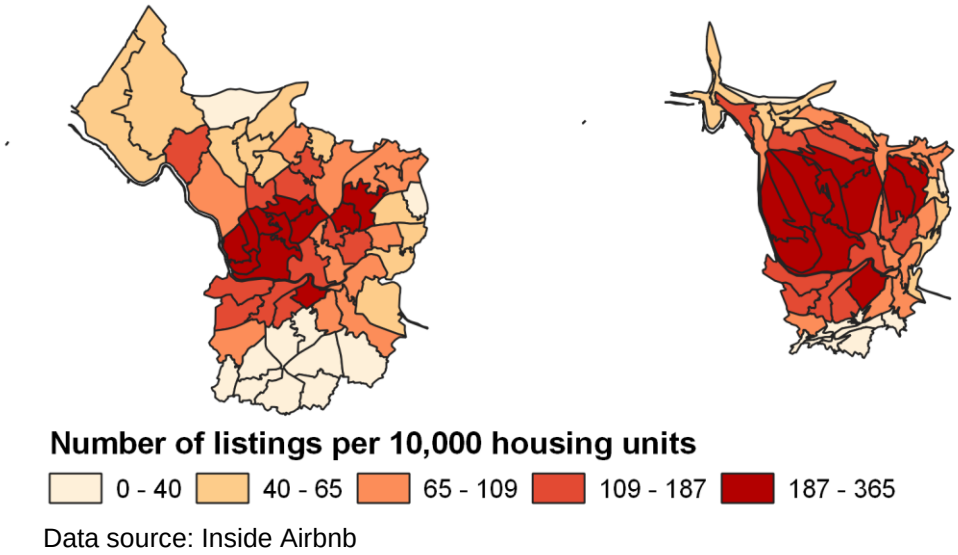


Figure 4-3 Airbnb listing distribution (left) and diffused cartograms showing reshaped cities by the concentration of Airbnb listings in neighbourhoods (right) in Bristol, 2023. (Own elaboration)

Pricing for Airbnb listings in Bristol is highly variable. In 2020, average nightly rates were approximately £114 for an entire home and £44 for a private room. Bristol city centre commanded the highest prices, often over £120 per night. The most popular areas for Airbnb listings in Bristol are the city centre, Clifton, and Southville. These areas are all home to a large number of attractions, including museums, art galleries, and restaurants. They are also well-connected by public transport, making them ideal for visitors to the city.

The growth of Airbnb listings in Bristol has brought some positive developments for the city. It has helped to provide different accommodation options for visitors, and it has also generated income for local businesses. However, there are some concerns about the impact of Airbnb on the city's housing market (Voltes-Dorta & Inchausti-Sintes, 2020). These concerns will need to be addressed in order to ensure that the growth of Airbnb does not adversely affect the city's residents.

In sum, this section has examined the trends in Airbnb listings across different cities, and how they reshaped the city. The rapid growth of Airbnb listings poses

significant challenges and opportunities for urban planning, housing affordability, neighbourhood cohesion, and local development. To achieve a sustainable balance between the benefits and costs of short-term rentals, it is crucial to develop and implement effective regulations that are tailored to the specific contexts and needs of each city.

4.3 Regulatory efforts on Airbnb: from international to UK

Compared to the American birthplace of Airbnb or other thriving global cities, Airbnb's proliferation has been less pronounced in the UK. To understand how Airbnb can be better regulated in the UK, it is useful to look at how other places have dealt with the platform's rapid expansion and its negative effects on a variety of aspects. This calls for a nuanced examination of international regulatory experiences. By dissecting how different regions have tempered the platform's explosive growth with tailored policies aimed at taxation, zoning, housing rights, and community impacts, England can distil critical insights and best practices.

4.3.1 Regulation evolution timeline: the international experience

From New York to San Francisco, Amsterdam to Barcelona, the regulatory spectrum is wide and variegated. In some locales, measures have been relatively light-handed, seeking to encourage innovation and consumer choice, while others have necessitated strict controls in an effort to preserve housing affordability and community character. As the UK embarks on its own regulatory journey, it must weigh the international regulatory landscape and its many strategies against the unique structure of its cities, economy, and citizens. This exploration of international experience will provide the UK with a source of wisdom and foresight that will be vital in integrating Airbnb into its national landscape in a progressive and measured way.

Since Airbnb's launch in 2008, San Francisco has undergone significant regulatory changes (see Table 4-1). Initially, short-term rentals of less than 30 days were illegal. However, starting in February 2015, hosts were allowed to register homes for limited rentals of at least 275 nights per year, with associated fees and taxes (Guttentag, 2015). An agreement in August 2017 between Airbnb, HomeAway, and the city allowed only registered rental properties on platforms, resulting in a noticeable reduction in listings. Further regulations in 2018 required hosts to register directly with the city, bypassing platforms, and increased registration fees in 2023 (Heyward, 2022).

Airbnb's journey in New York began in 2008 without regulation. However, in 2010, the New York State Assembly passed a law prohibiting the use of residential apartments as hotel rooms, setting a minimum lease duration of 30 days (The New York State Senate, 2010). This law came into effect on May 1, 2011, but ambiguities led to loopholes (Segan, 2012). Recent legislation imposes fines on advertising

short-term rentals for the entire unit for less than 30 days when the host is absent, with violators facing fines of up to $7,500. Research indicates a reduction in monthly income for regulated Airbnb listings due to these regulations (Yeon et al., 2020). In 2018, the City Council passed a bill requiring Airbnb to provide monthly data on listings to assist enforcement. Airbnb began sharing detailed information with landlord consent in 2020 (Airbnb, 2023). The Short-Term Rental Registration Law in 2023 mandates hosts to register with the Mayor's Office of Special Enforcement (OSE), leading to a significant decline in listings (Jorden, 2023; OSE, 2023).

Before 2014, Airbnb operated in Amsterdam with minimal regulation. In response, the city established a regulatory framework in 2014, introducing a new accommodation category called 'private rental.' This framework limited guest numbers and unhosted rentals to 60 days per year (Li & Canelles, 2021). Strict fines were imposed for violations, and a cooperation agreement with Airbnb (Andrews, 2017) was initiated in 2017 to promote responsible rental behaviour. Mandatory reporting requirements for residents and an automatic limit on rental days were introduced in subsequent years. Amsterdam further reduced the rental days to 30, implemented a licensing system for holiday rentals (Airbnb, 2017), and restricted such rentals to principal inhabitants from 2020 (Hübscher & Kallert, 2023; Amsterdam, 2021; Rekenkamer Amsterdam, 2019).

Barcelona, at the forefront of regulating the short-term rental market, implemented measures in the early 2010s to balance tourism and residents' livability. The city introduced its first major policy in 2012, which included a nightly tourist tax and a free registration system (Catalonia News, 2012). In 2014, it mandated all short-term rental operators to register and license, leading to the removal of many illegal listings (Feargus O'Sullivan, 2015). By 2016, Barcelona imposed hefty fines for unlicensed home sharing to regulate tourist housing and reduce market saturation (Calvo, 2016). In 2017, the city launched the Special Urban Plan for Tourist Accommodation (PEUAT), introducing zoning policies to prevent overcrowding (Barcelona City Council, 2017). A website was also launched for residents to check property licences and report illegal listings. Airbnb suspended hosts without a licence or those exceeding one listing per host. In 2021, Barcelona became the first major European city to ban short-term private room rentals, allowing only licensed entire apartment rentals (Caayao, 2021).

Table 4-1 Airbnb regulations in a selection of international cities. (Own elaboration)

City	Origin	Practice	Type	Outcome	Date
New York	Targeting landlords who were running illegal hotels.	New York State passed a law that made it illegal to rent out an entire dwelling for fewer than 30 days.	Law	Largely unregulated	2010

	The 2010 law was rarely enforced and often ignored by short term rental hosts.	Governor Andrew Cuomo signed legislation that imposed heavy fines on Airbnb hosts who broke the 2010 law. These fines could go up to $7,500.	Amendments	Listing number and revenue decrease	2016
	The New York City Council passed a bill that required Airbnb and other home-sharing platforms to provide detailed data on their listings, which would aid in the enforcement of the law.	Airbnb immediately commenced settlement negotiations with the New York City, agreeing to share the anonymised data of illegal hosts	Collaboration	Law enforcement	2018
	Essentially allowing enforcement to focus on hosts with multiple listings or those who remove long-term housing from the market	Airbnb agreed to provide the city with host data, but with reduced scope compared to the original 2018 regulation.	Compromise	Stronger enforcement	2020
	Reduce the number of illegal short-term rental listings	Require hosts to register with the city to be allowed to rent on a short-term basis.	Registration	Strict, de facto ban	5 Sep. 2023
San Francisco	Hotel Conversion Ordinance was in place	San Francisco banned residential rentals of less than 30 days in multi-unit buildings.	A ban that made most Airbnb-type rentals illegal	The law was rarely enforced	Prior to 2015
	Legalise short-term rentals and balance the benefits with its potential downsides	Residential units can rent for up to 90 un-hosted nights within a calendar year. Hosts are also required to register and pay a $250 fee for biennial registration.		Many hosts initially ignored the new law	2015
	Cover the operating costs for administering the City's short-term rental program	The Office of Short-Term Rentals raised the biennial registration fee to $450.	Application fee		2019
	Enhanced Oversight and Compliance Measures	Hosts are required to register their short-term rentals directly with the City of San Francisco instead of on platforms like Airbnb.	Amendments	More regulated environment	Mar. 2022

	Raising the entry barriers	The registration fee was raised again to $750.	Application fee	—	2023
Amsterdam	Protect the city from over tourism	Limit the number of guests to four at a time and unhosted renting to a maximum of 60 days per annum.	Voluntary Memorandum	Regulatory Onset	2014
	Comply with local regulations	Platform collects tourist tax from hosts and remit it to the city government.	Tourist tax	Decrease in Airbnb's annual revenue	2016
	Restricting P2P rental for long-term use	A maximum of 30 nights a year.	Mandatory Day limit	Tighten the rules	2019
	Large number of violations	Airbnb hosts must obtain both a registration number and a permit for a vacation rental.	Registration	Rigorous Enforcement	2020
Barcelona	Catalonia has a tax for all tourist accommodations	A small nightly tourist tax and a free registration system.	Tourist tax	Largely unregulated	2012
	An increase in unregistered tourist accommodations	Barcelona passes the first regulations, requiring hosts to register listings with the city. Fines are issued for those not complying.	Registration	Many illegal listings were removed	2014
	Large number of violations	Fines up to €600,000 can be issued to major offenders for listing non-registered apartments.	Fine		2016
	Regulatory difficulties	Launched new tools to randomly check illegal listings.	Enforcement	Suspended hundreds of hosts	2018
	Limit over tourism	Banned short-term rentals for less than 31 days	Ban	Stringent ban	2021

4.3.2 How UK cities' regulations are responding to Airbnb

Airbnb growth trajectory suggests an impending need for a regulatory recalibration. Here is a brief timeline of how Airbnb has been regulated in four UK cities: London, Manchester and Bristol (see Table 4-2).

4.3.2.1 Greater London

Prior to the Deregulation Act in 2015, Londoners were restricted in renting out their homes for short periods without first obtaining planning permission due to the Greater London Council (General Powers) Act of 1973. The Act amended the situation by allowing Londoners to rent out their homes on a short-term basis for up to 90 days in a calendar year without the need for planning permission.

However, since January 2017, Airbnb has implemented an automatic limit on the number of nights that hosts can offer their homes in Greater London. The limit

is set to the legal maximum of 90 days per year unless the hosts have the necessary permits to host more often. If hosts violate this rule, they could face a fine of up to £20,000 for unauthorised change of use.

In 2023, some local authorities, such as Westminster, have been demanding more powers to deal with the problems caused by short-term rentals. Westminster (2023) has also advocated for a registration scheme for short-term rentals. At the same time, the Department for Culture, Media and Sport has launched a consultation on a registration scheme for short-term rentals in England.

4.3.2.2 Greater Manchester

While nationwide planning permission guidelines apply to all local councils, as of October 2022, there isn't a Greater Manchester-wide specific policy (KeyNest, 2022). Individual city councils within the metropolitan area are responsible for addressing potential issues or unauthorised operations within their jurisdictions. However, enforcing these regulations poses significant challenges due to limited resources and complexities in identifying non-compliant properties. Recent developments suggest that Manchester City Council has sought to prevent new homes on land it owns in Brunswick, South Manchester, from being turned into short-term rentals (Yates et al., 2021). Other councils may have taken the same approach to deal with similar situations, but comprehensive and coordinated actions across Greater Manchester remain scarce.

Table 4-2 Current Airbnb regulations in UK case study cities. (Own elaboration)

City	Origin	Practice	Type	Outcome	Period
Greater London	Maintain a balance between the availability of long-term housing and the flexibility of short-term lets.	A maximum of 90 nights in a calendar year set by Airbnb system.	Mandatory Day limit	Annual operation days were limited	2017.01-(Ferreri & Sanyal, 2018)
	Better manage the impact of short-term lettings on local housing supply.	The City of Westminster called for a compulsory registration scheme for all short-term rental properties to help enforce the rule.	Local proposal	Non-substantive	2023
Greater Manchester	Seek advice to better enforce regulation	As of October 2022, Manchester has no local-specific regulations.	No	Mainly self-regulated	Up to 2023

Bristol	The council said it wanted to balance the benefits of tourism and the sharing economy with the impacts on housing supply, community cohesion and public services.	Lack of regulatory control	No	Mainly self-regulated	Up to 2023

4.3.2.3 Bristol

Although property owners across the country have to follow the nationwide 90-day limit on renting out their homes, this rule is not enforced uniformly across different cities. Unlike London, there is no such built-in mechanism within the platform to prevent hosts from exceeding the cap in Bristol. This means that local authorities in Bristol have to rely on other methods to monitor and regulate the short-term rental market, which can be more challenging and resource intensive.

4.4 Implications for theory and policy

Regulations established by the platforms themselves tend to align with corporate interests, primarily aimed at maximising profits. Hence, self-regulation may fall short in safeguarding the interests of both workers and the general public (Hübscher & Kallert, 2023). Consequently, municipal or state-wide regulations are pivotal in ensuring that private interests do not outweigh public welfare.

The comparative analysis of international regulatory responses to P2P accommodation services like Airbnb highlights substantial developments and their consequential relationship with urban housing markets. Municipal authorities have engineered various regulatory mechanisms aimed at mitigating the adverse externalities on residents and the local tourism industry whilst capitalising on the economic opportunities presented. Such measures typically encompass restrictions on the duration of rentals, implementation of registration and safety protocols, and the imposition of relevant taxes and fees (Colomb & Moreira De Souza, 2021).

Cities like New York, San Francisco, Amsterdam and Barcelona institute stringent controls over short-term rentals, imposing strict operational boundaries (Stabrowski, 2017; Said, 2017; Aguilera, Artioli, & Colomb, 2019; Heyward, 2022). These cities are examples that work with platform intermediaries and community stakeholders early on. They modify regulations as part of their tourism planning process, reflecting an active engagement in tourism governance. This underscores

the municipality's commitment to maintaining an equitable balance between economic advantages and the reduction of potential detriments. In contrast, cities such as London have engaged in earnest discussions over the rigidity of regulatory measures but subsequently transitioned towards more deregulated and accommodating policies (Ferreri & Sanyal, 2018).

Drawing on a comprehensive overview of regulatory practices, the following theoretical implications emerge from a multitude of vantage points:

- Spatial Impact: STR regulations impact supply-and-demand dynamics in the housing market, potentially alleviating or exacerbating housing shortages (Heyward, 2022). Regulatory enactments influence geographic distribution patterns of rentals (Colomb & Moreira de Souza, 2023), prompting the dissemination of listings from central to peripheral areas. The P2P accommodation industry's adaptability attests to the fact that regulatory interventions often result in only a temporary contraction in listings without a prolonged effect on core metrics.
- Regulatory Challenges: The ascent of Airbnb and similar P2P platforms necessitates innovative theoretical models to understand technology-induced marketplace transformations. The rise of P2P accommodation platforms like Airbnb presents significant regulatory challenges for destinations, as they must balance the economic benefits with the need to protect residents from negative externalities (Nieuwland & van Melik, 2018).
- Regulatory Frameworks: Varied regulatory approaches reflect different theoretical underpinnings, from laissez-faire doctrines to frameworks that foreground community welfare and equitable urban access. One size does not fit all; regulations are tailored to the specific needs and contexts of individual cities (Wegmann & Jiao, 2017). Cities adopt highly individualised regulatory approaches to short-term rentals, reflecting diverse urban settings and policy objectives.
- Dynamic Adaptation: City administrators and platform operators continuously adapt to changing regulations, this dynamicity functions as a regulatory mechanism that helps to control the proliferation of STRs (Hübscher & Kallert, 2023).

The policy implications propose the following central concepts within the frameworks:

- Affordable Housing Preservation: Pertinent regulations should strike a balance between the economic benefits of short-term rentals and the need to preserve affordable housing stock. Regulations may include caps on the annual letting days or zoning restrictions (Bei & Celata, 2023).
- Taxation and Revenue: Imposing taxation on short-term rentals not only ensures fairness compared to conventional lodging entities but also generates

funds for municipal investments in housing or infrastructure (Kaplan & Nadler, 2015).

- Data Sharing: Regulations may require platforms to collaborate with cities by sharing data to enforce compliance and monitor the effects on local housing markets (Agustin Cocola-Gant et al., 2021).

Given the UK's predominantly liberal governance stance, more research is needed to fully understand the current development status of P2P accommodation, the impact of its development on housing and tourism and potential implications of imposing further regulations.

CHAPTER 5
SPATIO-TEMPORAL DYNAMICS OF PEER-TO-PEER ACCOMMODATION WITHIN CITIES

5.1 Introduction

The rise of P2P accommodation rental platforms, such as Airbnb, has significantly expanded the use of traditional apartments as temporary hotel rooms worldwide (Janasz et al., 2022), driving a new business model for tourist accommodation and reshaping the geographical distribution of the hospitality industry.

Analysing the spatial distribution can help us understand the reasons behind the emergence and maturity of Airbnb (Eugenio-Martin, Cazorla-Artiles, & González-Martel, 2019; Sun, Wang, & Hu, 2022). In the context of the sharing economy, P2P accommodation spread through cities, transforming the stock of tourist accommodation in cities. This has a potentially extensive spatial economic spillover effect and has triggered discussions about how disruptive technological innovation is reshaping urban spatial structures (Sigala, 2017; Neuts, Kourtit, & Nijkamp, 2021). Despite the rapid development of sharing accommodation attracting extensive attention across multiple disciplines, there is a scarcity of research comparing cities and analysing spatial variations.

The spatial location of the hospitality industry directly influences the success of hotel operation. While there is abundant research on the spatial layout of traditional accommodation, P2P accommodation management, customer motivation, and host-guest interaction (Belarmino & Koh, 2020; Janasz et al., 2022; Pung, Del Chiappa, & Sini, 2022), studies on the spatio-temporal expanding pattern of short-term rentals are relatively limited. As a newcomer to the hospitality industry, Airbnb is distinct from traditional hotel accommodation in terms of space, time, experience, and brand culture due to its unique business model (Anwar, 2018). Differences in P2P accommodation's business model, location choice, and room selection may lead to different spatial configurations.

P2P platforms have the potential to create rent gaps between the actual and potential ground rents of a property, as property owners can generate higher income from short-term rentals than from long-term rentals. These rent gaps can have significant impacts on the urban landscape and drive a new form of gentrification (Wachsmuth & Weisler, 2018). Yet, not all neighbourhoods are equally susceptible to rent gaps (Neuts, Kourtit, & Nijkamp, 2021); different socio-economic and demographic factors may influence the demand and supply of short-

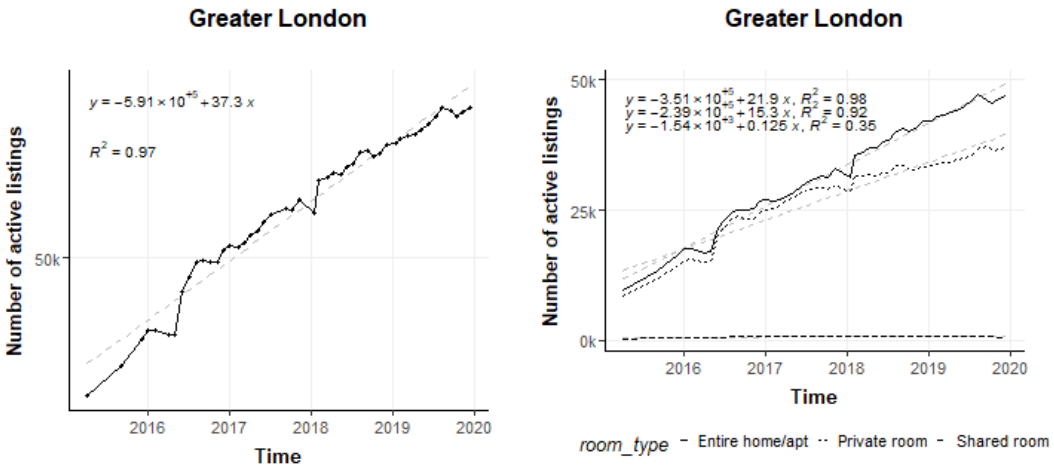
term rentals in different areas, so it is important to observe the process of the opening of rent gaps through multiple perspectives. Given the spatial uncertainty of rent gaps across the neighbourhoods of each city, urban planners may also want to identify the areas with higher risk of gentrification and characteristics of neighbourhoods that are more likely to create rent gaps and how they vary across different cities.

To evaluate Airbnb's growth more effectively, this chapter includes identifying the patterns and trends of Airbnb distribution and growth and exploring the relationship between neighbourhood characteristics and rent gaps in three major UK cities. Such analysis contributes to the literature on the spatio-temporal pattern of short-term rentals and rent gap theory, offering insights for policymakers and stakeholders to address the challenges and opportunities posed by P2P platforms.

5.2 Spatio-temporal characteristics of Airbnb in major cities of UK

5.2.1 Temporal dynamic characteristics of Airbnb in Greater London

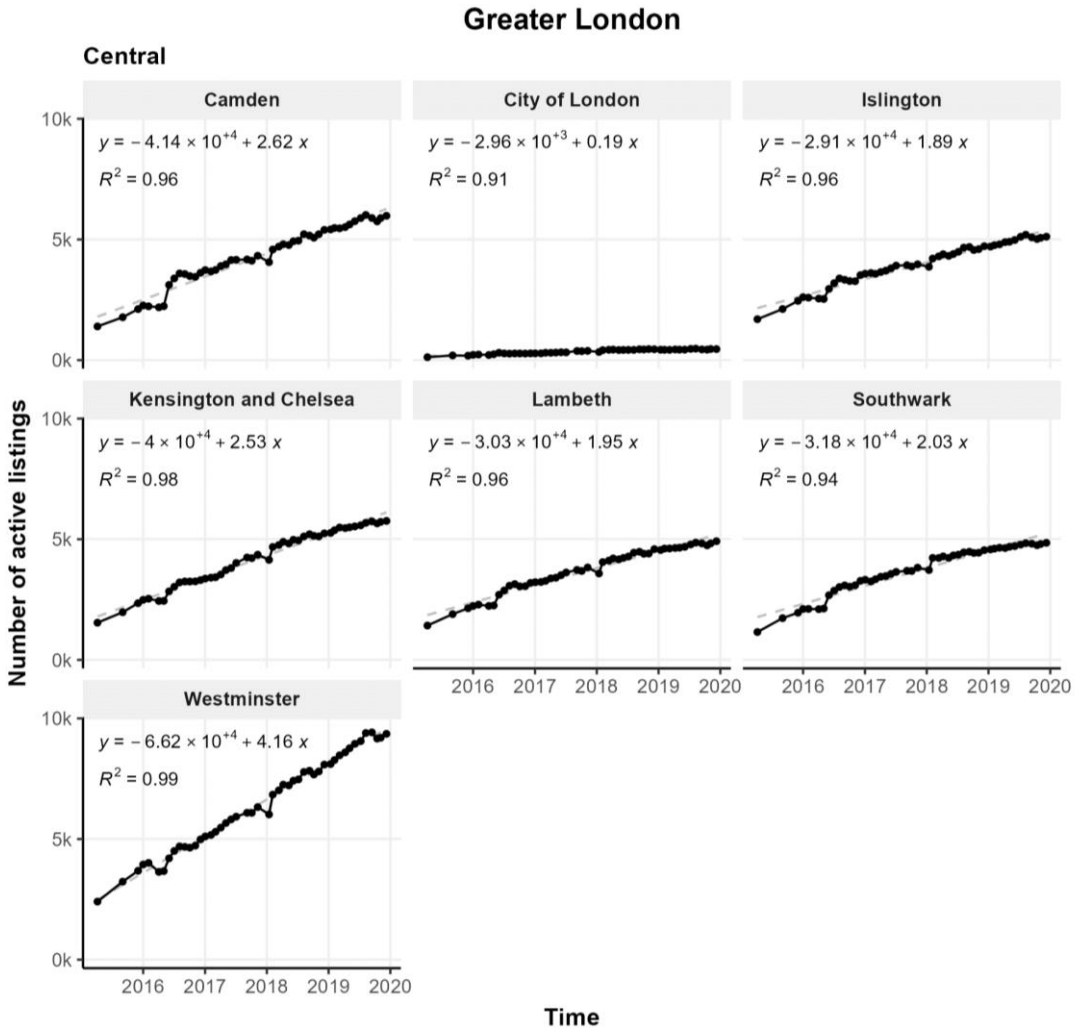
The growth trajectory of Airbnb listings across each local authority in London indicates a general upward trend over the study period (Figure 5-1). Active listings saw a significant increase, rising from 18,382 in April 2015 to 84,724 in December 2019. The data reveals an average growth rate of up to 1,119 listings per month. Notably, the growth rate was more rapid until July 2016, after which it began to decelerate. From Airbnb's room type statistics in London, the main room types of London are entire home and private room. The number of entire home listings is the largest and fastest growing of the three, with an average of 657 entire home listings added per month in Greater London; private rooms also grew quickly, from 8,472 at the beginning of the study period to 37,097 at the end of the study period, with an average increase of just 459 per month, and the number of private room listings is very close to the number of entire home listings until March 2018, after which the growth rate slows down; shared rooms only averaged 500 or 600 listings, with a peak of 765 and no growth trend, making the shared room offering less than 10% of the other two room types. Despite the overall growth of Airbnb in London, the trajectory of the number of Airbnb listings varies across sub-regions and boroughs. Specifically, Airbnb numbers are growing faster in Central London, moderately in East, South and West London and more flatly in North London. The changes in Airbnb numbers are explored next by region.



Data source: Inside Airbnb

Figure 5-1 The growth trend of Airbnb listings with linear fitting of Greater London. (Own elaboration)

In terms of sub-region, Central London has been consistently higher than the London-wide average for Airbnb from 2015 to 2019, and Airbnb has grown strongly in the Central region (see Figure 5-2), with an increasing gap to the London-wide average, adding an average of 462 listings per month here, growing from 9,736 at the beginning of the study period to 36,443 at the end of the study period, during 2019-08 there was a peak of 36,458 active listings. Firstly, the fastest growth rate was in Westminster, where an average of 125 listings were added per month, from 2,407 at the beginning of the study period to 9,360 at the end of the study period, with a slightly faster growth rate until 2016 and no significant slowdown as the volume increased thereafter. In addition, the slowest growth rate in Central London was in the City of London, where the number of Airbnb has remained low over the study time frame, from 121 at the beginning of the study period to 456 at the end of the study period, with an average increase of only 5.7 listings per month. This may be due to the small size of the City of London and the fact that the value of homes here is relatively high, and homeowners are reluctant to use their homes as P2P accommodation.

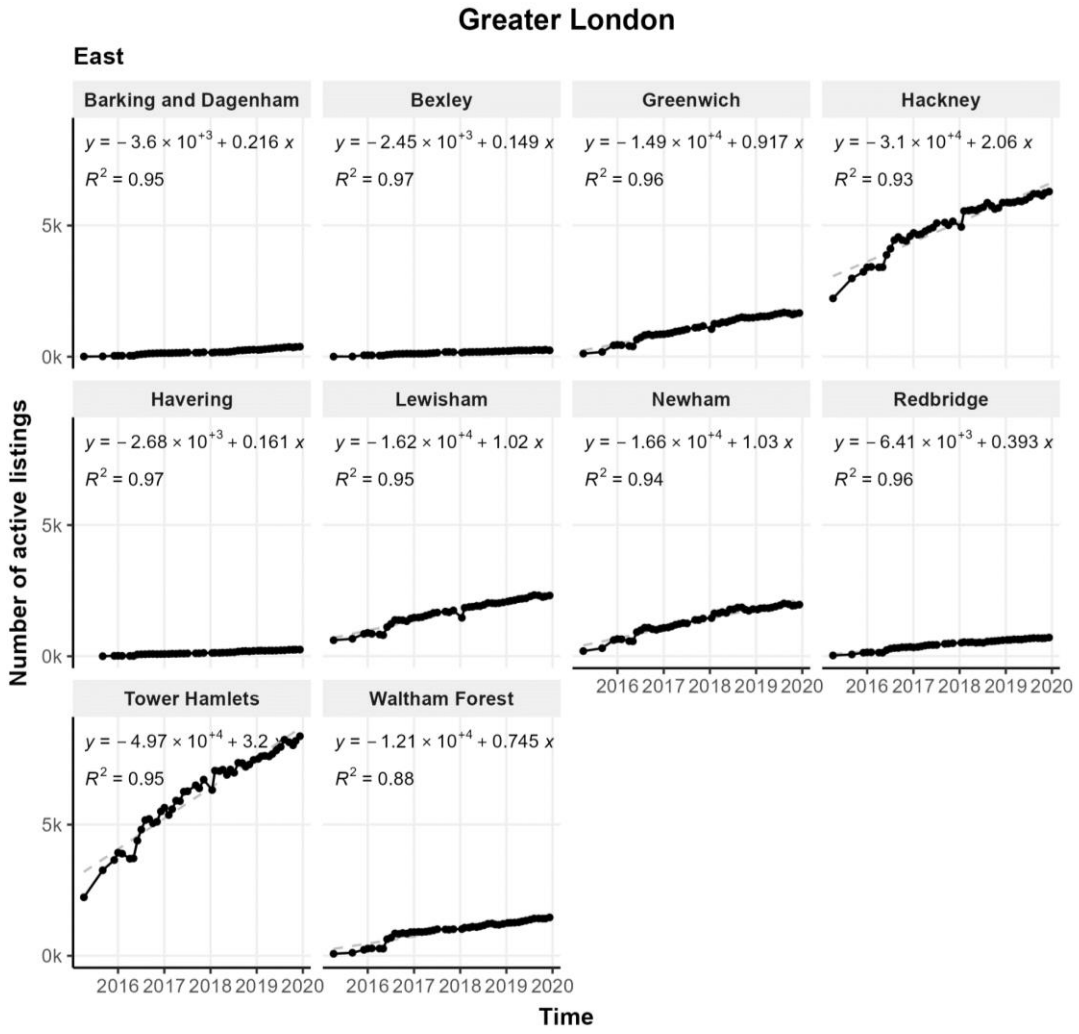


Data source: Inside Airbnb

Figure 5-2 The growth trend of Airbnb listings with linear fitting of Central London. (Own elaboration)

The number of Airbnb properties in East London has also been consistently higher than the average for London as a whole from 2015 to 2019, and with the rapid growth of Airbnb in the East (see Figure 5-3), the gap with the London-wide average has broadened, adding an average of 297 listings per month here, growing from 5,500 at the beginning of the study period to 23,674 at the end of the study period, with the trend of increasing in numbers being very similar to that of the Central London, where the growth rate has only moderated since 2019. Firstly, the fastest growth was in Tower Hamlets, where an average of 96 listings were added each month, from 2,230 at the beginning of the study period to 8,371 at the end of the study period. The growth rate was slightly faster until 2016, when an average of 167 listings were added per month, after which the rate of growth gradually slowed. Overall, the linear fit has a 95% goodness of fit, implying a certain linear pattern, but with an overall trend of faster and then slower growth. Secondly, in Hackney, which is adjacent to Tower Hamlets, the growth rate of Airbnb is also rapid, adding

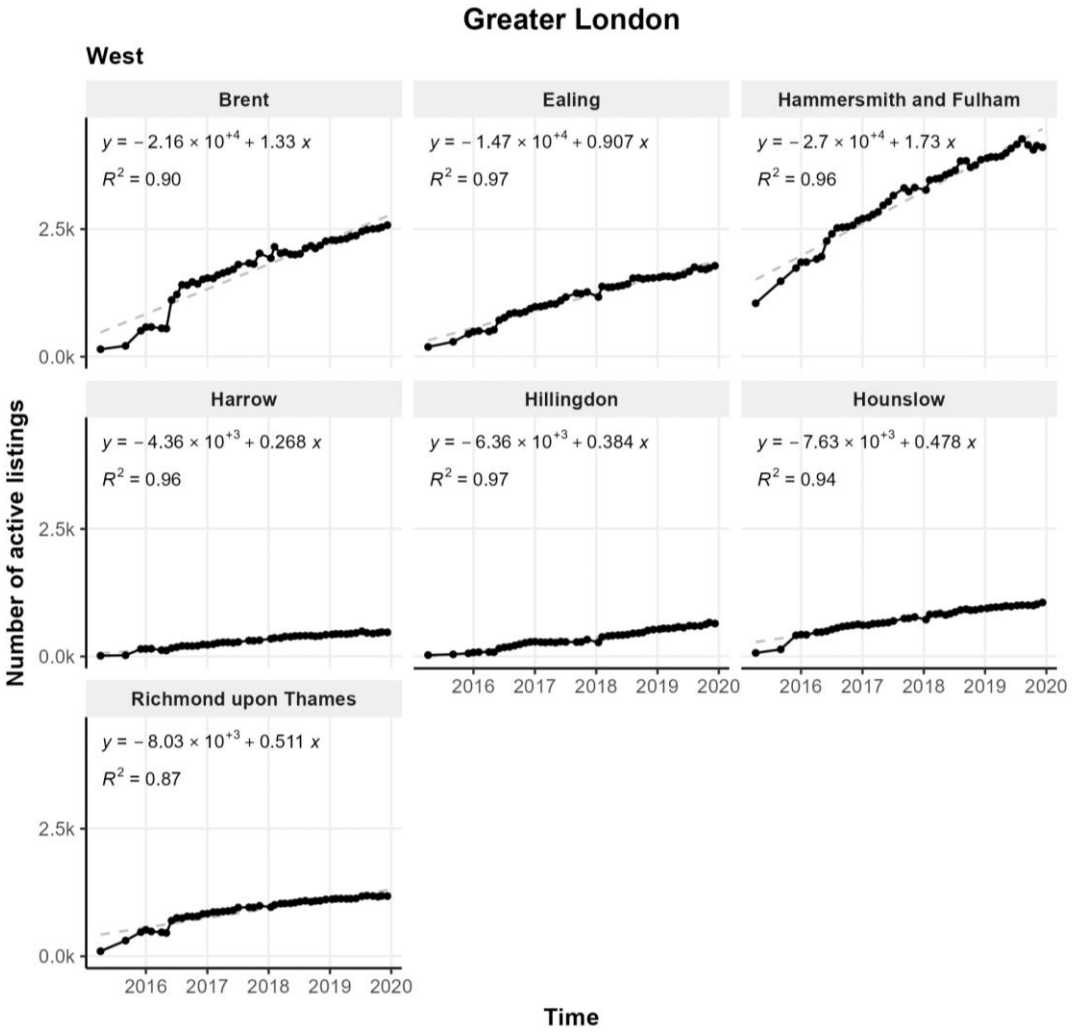
an average of 62 active listings per month, increasing from 2,222 at the beginning of the study period to 6,295 at the end of the study period, very similar to the growth curve of Tower Hamlets. The slowest growth rate in East London was in Bexley, where the number of Airbnb's remained low over the study timeframe, slowly increasing from just 5 at the beginning of the study period to 244 at the end, reaching a peak of 269, with an average increase of only around 4.47 listings per month. Other boroughs such as Greenwich, Waltham Forest, Redbridge, Barking and Dagenham, and Havering all fall into the category of boroughs with an average growth rate of 30 listings per month or less. As the most remote boroughs in the east of Greater London, there are few amenities and attractions to support the development of P2P accommodation.



Data source: Inside Airbnb

Figure 5-3 The growth trend of Airbnb listings with linear fitting of East London. (Own elaboration)

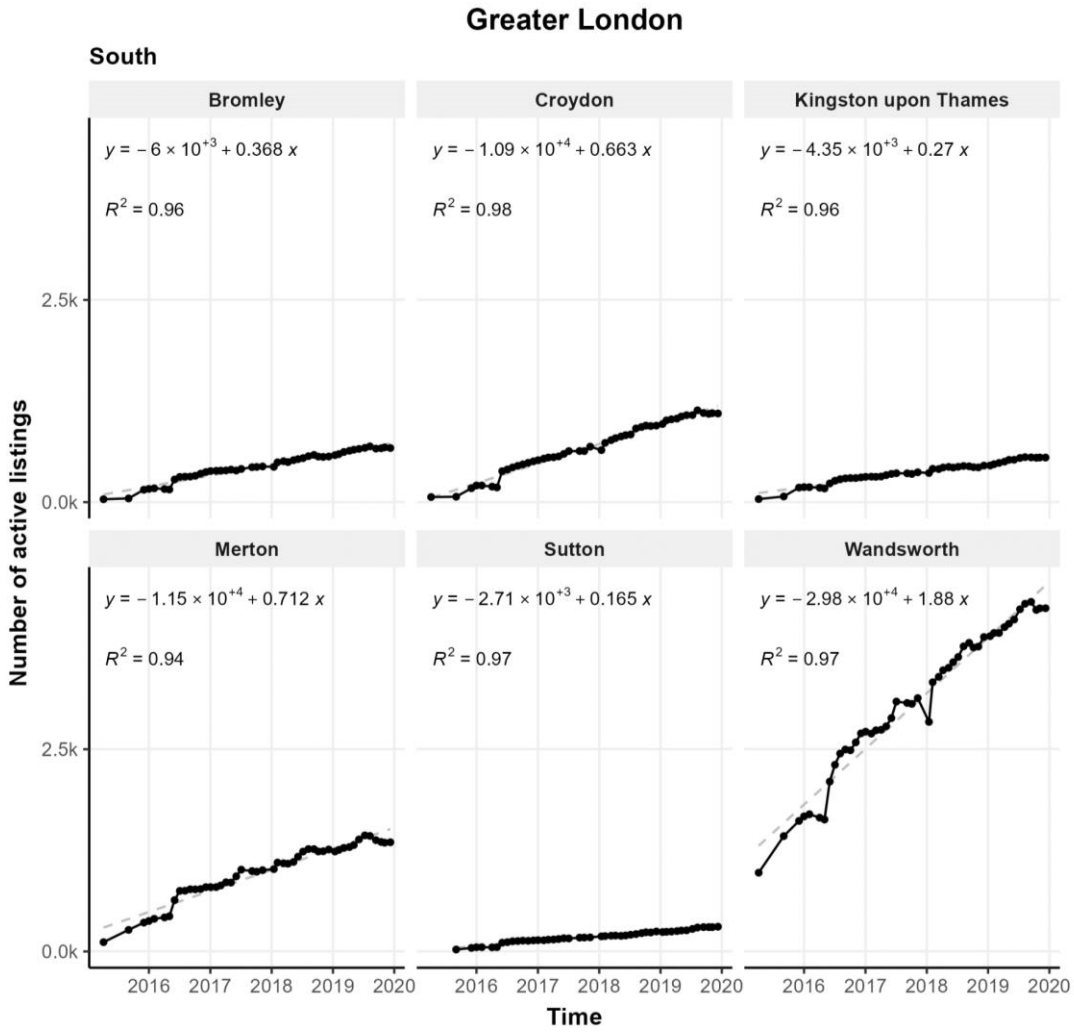
The number of Airbnb's in West London from 2015 to 2019 is already below the average for London as a whole, and there is a gap with the London-wide average as Airbnb grew slowly in West London (see Figure 5-4). An average of 168 listings were added here each month, growing from 1,598 at the beginning of the study period to 11,823 at the end, with a relatively flat trend in volume growth. Firstly, the fastest growth was in Hammersmith and Fulham, where the average monthly increase was around 52 listings, from 1,047 at the beginning of the study period to 4,105 at the end of the study period. This level is not even close to that of Hackney in Central London and East London. Moreover, the slowest growth rate was in Harrow, where the average number of listings increased by around 8 per month, from 15 at the beginning of the study period to 473 at the end. This level of growth is slower in London and is only faster than Barking and Dagenham, Havering and Bexley in East London.



Data source: Inside Airbnb

Figure 5-4 The growth trend of Airbnb listings with linear fitting of West London. (Own elaboration)

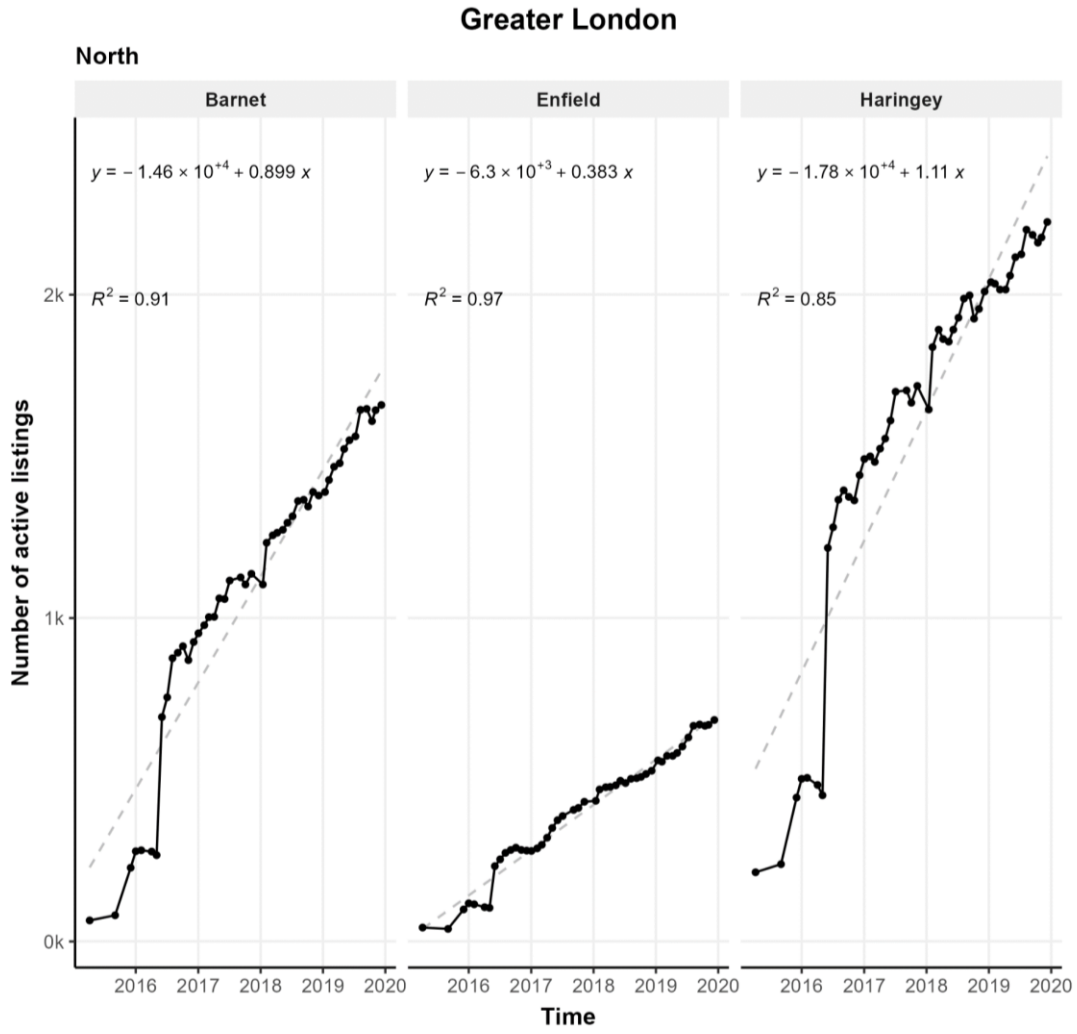
The number of Airbnb in South London from 2015 to 2019 is lower than the average for London as a whole, with a level of development between the West and North. As Airbnb grew slowly in the South (see Figure 5-5), having added an average of 120 listings per month here, from 1,226 at the beginning of the study period to 8,215 at the end, with small jumps after April 2016 and January 2018, the overall trend in volume growth was very flat. Firstly, the fastest growth was in Wandsworth, where an average of around 56 listings per month was added, from 974 at the beginning of the study period to 4,243 at the end, which is a slightly higher level than Hammersmith and Fulham in West London. In addition, the slowest rate of growth was in Sutton, where an average of around 5 listings per month were added, from 24 at the beginning of the study period to 306 at the end, and this level is low compared to both London as a whole and the rest of the South.



Data source: Inside Airbnb

Figure 5-5 The growth trend of Airbnb listings with linear fitting of South London. (Own elaboration)

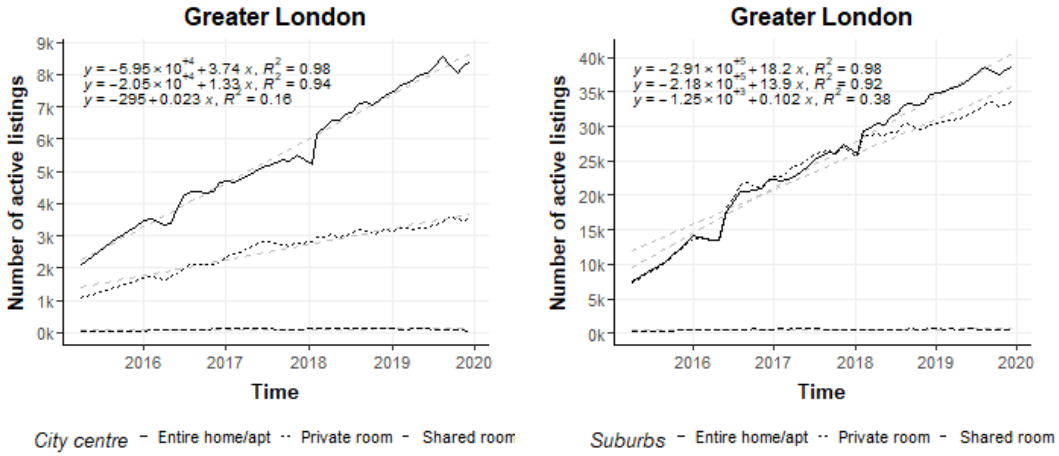
The number of Airbnb in North London from 2015 to 2019 has been well below the average for London as a whole and is the slowest expanding area of the whole London Airbnb market (see Figure 5-6), with the number of Airbnb listings fluctuating less, adding an average of 72 listings per month here, growing from 322 at the beginning of the study period to 4,569 at the end of the study period. This is largely due to the small number of boroughs contained in North London. Of the three North London boroughs, the fastest growth rate was in Haringey, where an average of around 33 listings were added each month, from 214 at the beginning of the study period to 2,225 at the end of the study period, reaching a medium level for London with a weak linear trend. In addition, the slowest growth rate was in Enfield, where an average of around 11 listings were added per month, from 43 at the beginning of the study period to 685 at the end, but this level is not the lowest in London.



Data source: Inside Airbnb

Figure 5-6 The growth trend of Airbnb listings with linear fitting of North London. (Own elaboration)

Looking at the core-periphery, the number of Airbnb's in London city centre from 2015 to 2019 showed certain upward trend, growing from 3,206 at the beginning of the study period to 11,970 at the end of the study period (Figure 5-7), with a linear fitted growth rate of 153 listings added here each month. Looking at room types of Airbnb in the core area, entire home listings is the most numerous of the three room types and the fastest growing, adding an average of 112 entire home listings per month in the city centre; private rooms grew slightly more slowly, adding only around 40 per month with an average level of around 2,676; shared rooms have only a sparse 100 or so listings, with a peak of 152. Many Airbnb products have spread to the wider suburban area, growing from 70,322 at the beginning of the study period to 326,926 at the end, an average of 4,320 listings added per month in the suburbs, with the number of listings in the suburbs being around 27.5 times higher than those in the city centre. Looking at room types of Airbnb in the suburban area, entire home listings are also the most abundant and most rapidly growing of the three, adding an average of 2,520 entire home listings per month in the city centre; private rooms are also growing at a decent rate, adding an average of 1,791 per month. In fact, the number of private rooms was remarkably close to the number of entire home listings until March 2018, after which it slowed down; the number of shared rooms has remained at an average of 2,491, an extremely gentle upward trend compared to the other two room types, with few offering this type of accommodation.



Data source: Inside Airbnb

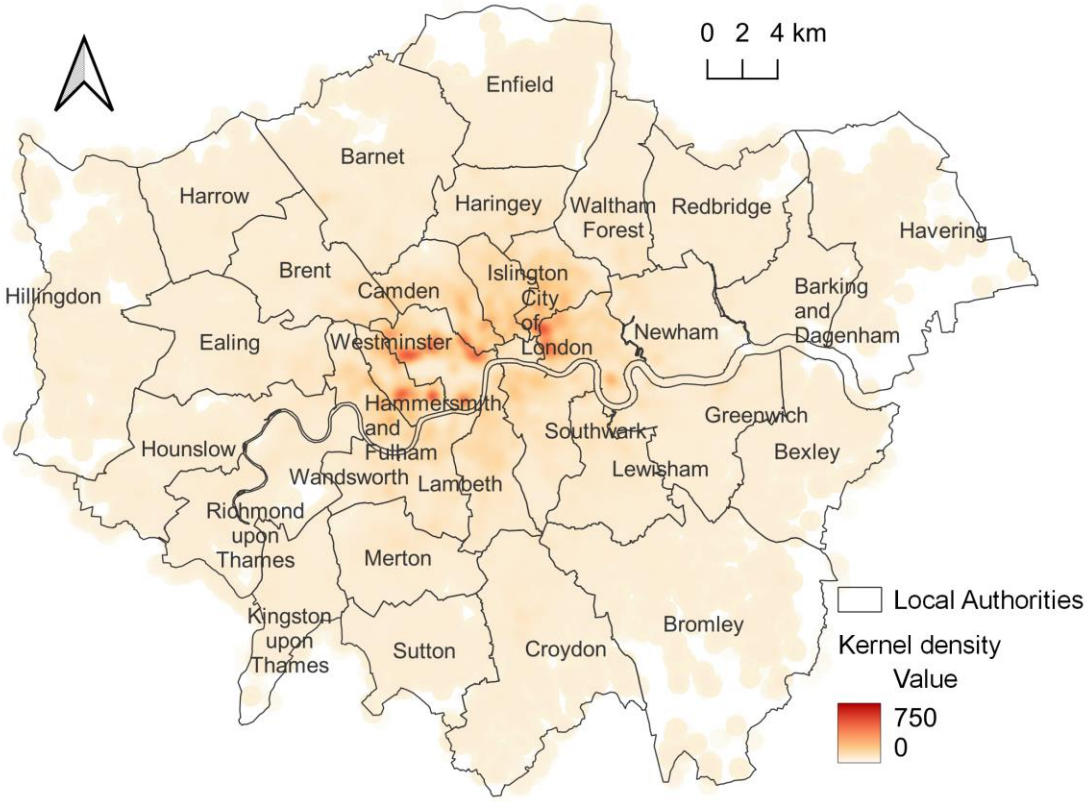
Figure 5-7 The growth trend of Airbnb listings with linear fitting of core-periphery of Greater London. (Own elaboration)

5.2.1.1 The spatial pattern of Airbnb in Greater London

According to the statistical summary, at the end of 2019 there were 84,727 active Airbnb listings in Greater London. Of the 4,835 LSOA statistical units examined, short-term rentals existed in 4,470 statistical units, leaving only 7.55% of units without any Airbnb accommodation products. The spatial distribution of P2P accommodation units has basically taken form, with Airbnb listings mainly located in the more affluent areas of the city centre, showing the characteristic of "overall concentration and multi-core development" (see Figure 5-8). Kernel density values tend to decrease from the core to the periphery. The three areas with the highest density are in Arnold circus (Weavers), Earls Court and Lancaster Gate. Arnold Circus has long been a hub for urban renewal initiatives in the borough (Rustin, 2016). Earls Court boasts rich history, attractive properties, vibrant nightlife, and excellent transport links. Lancaster Gate is home to a series of mansion blocks and busy streets with a diverse, energetic local population and high hotel density. Other areas like Pimlico, Bryanston and Dorset Square, and Soho also exhibit multiple smaller high-density clusters, magnets for Airbnb aggregation. Their suitability as holiday destinations and attractions like shopping draw various types of accommodation options. In general, the distribution of Airbnb listings in London is concentrated in a spatial pattern of multi-core clustering within an 8km radius of the city centre, low density Airbnb covers most of Outer London areas though it has no obvious clustering characteristic.

Table 5-1 Descriptive statistical summary of Airbnb listings in Greater London.

Room type		Entire home	Private room	Shared room	Total	Total number of statistical units
Greater London	Number of listings	47032	37098	597	84727	—
	Number of LSOA with listings	3627	4298	429	4470	4835
	Percent of LSOA with listings	75.02%	88.89%	8.87%	92.45%	—



Data source: Inside Airbnb

Figure 5-8 Kernel density estimation of Airbnb listings spatial distribution in Greater London. (Own elaboration)

There were 47,032 active entire home products in Greater London (Table 5-1). Among the 4,835 LSOA statistical units studied, 3,627 statistical units had entire home accommodation products and 24.98% of statistical units did not have any offerings. The spatial distribution pattern of entire home Airbnb which accounts for more than half of the overall listings is largely consistent with the spatial distribution pattern of overall listings, indicating that the high-density core of Airbnb listings in London consists mainly of entire home offerings.

There were a total of 36,204 active private room Airbnb accommodations in Greater London, with private room accommodations present in 4,293 of the 4,835 LSOA statistical units examined, and only 11.21% of statistical units without any private room Airbnb accommodation products. The number of private rooms occupies approximately 42.73% of the listings but its spatial distribution pattern differs markedly from that of the overall listings. Hosts in Outer London prefer to let out extra private rooms. The Weavers, Spitalfields and Banglatown neighbourhoods not only saw high concentrations of entire home listings, but also had the highest densities of private rental accommodation, with private room listings reaching a kernel density of 283.69. Weavers in particular have undergone substantial regeneration in recent years, bringing successive waves of

immigration, and have relatively high proportions of both social and privately rented properties, totalling 73.5% — far exceeding London averages. Many rental homes there may have been informally converted to P2P short-term lets. Spitalfields and Banglatown have recently regained prominence through culture-led regeneration supported by planning, building on ties to established fashion/arts communities and a burgeoning tourism industry. This likely fuelled growth in the short-term rental sector. Additionally, Pimlico sits at the south end of Westminster adjacent to the Thames, comprising a distinctive residential neighbourhood. The council there focuses on developing affordable housing, renovating or redeveloping apartment blocks while upgrading open spaces and parks. As of the 2011 census, there were approximately 9,500 households in Pimlico, of which over 90% of the house types were flats, 2,900 households had properties rented from social landlords, and approximately 3,600 homes were privately rented. Growth of Airbnb may correlate with expansion of the private rental sector.

Results depicting the spatial distribution of growth patterns across Greater London were obtained through DTW clustering (Figure 5-9). These patterns were categorised into three clusters: rapid growth, medium growth, and slow growth.

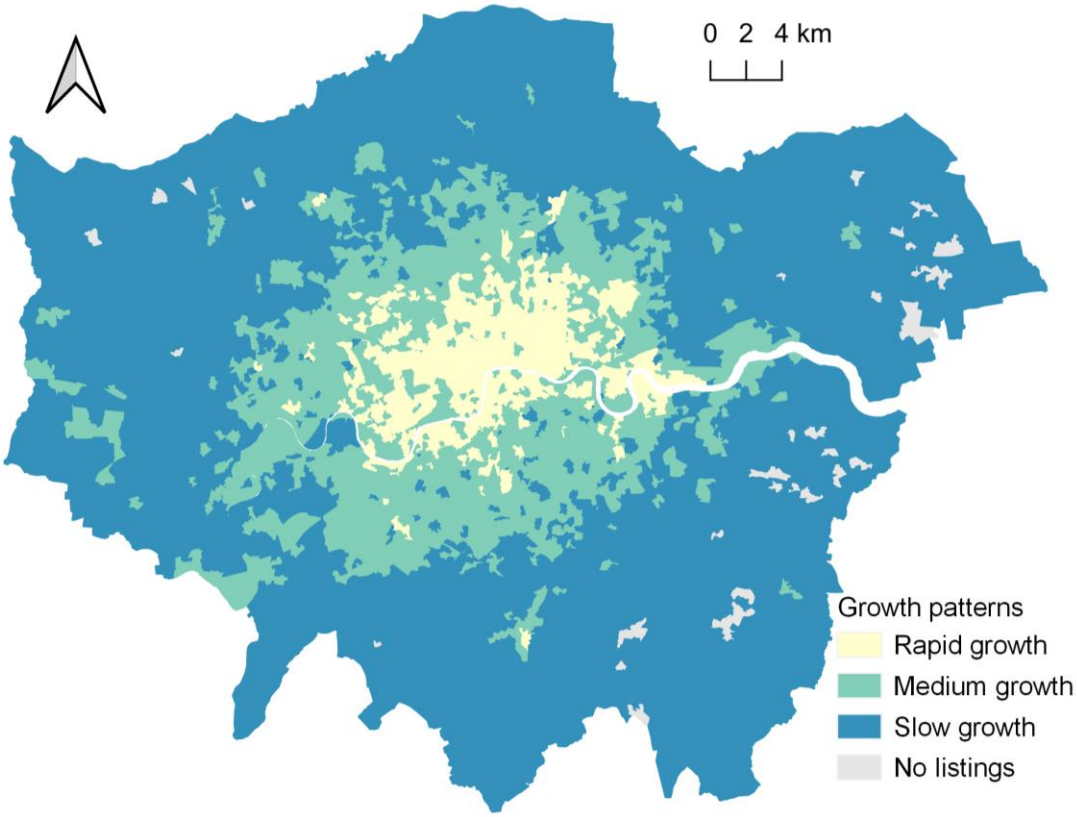


Figure 5-9 The spatial distribution of growth pattern clustering. (Own elaboration)

- Rapid growth

The rapid-growth areas are the largest, fastest growing and most volatile LSOAs for Airbnb in London, and there is a clear upward trend from the centroids of the cluster 2 (see Appendix Figure A-1), which has a growth range of 10-70 listings, with each rapid rise followed by a rapid fall. The actual growth in this cluster spans a wide range of 0 to 400 listings, with some statistical units showing multiples of growth compared to the beginning of the period. The geographical distribution of this cluster shows that the high growth of LSOAs is concentrated in the city centre, from Hammersmith and Fulham to Tower Hamlets and from Stoke Newington to Queenstown, which is in line with the reality of Airbnb growth.

- Medium growth

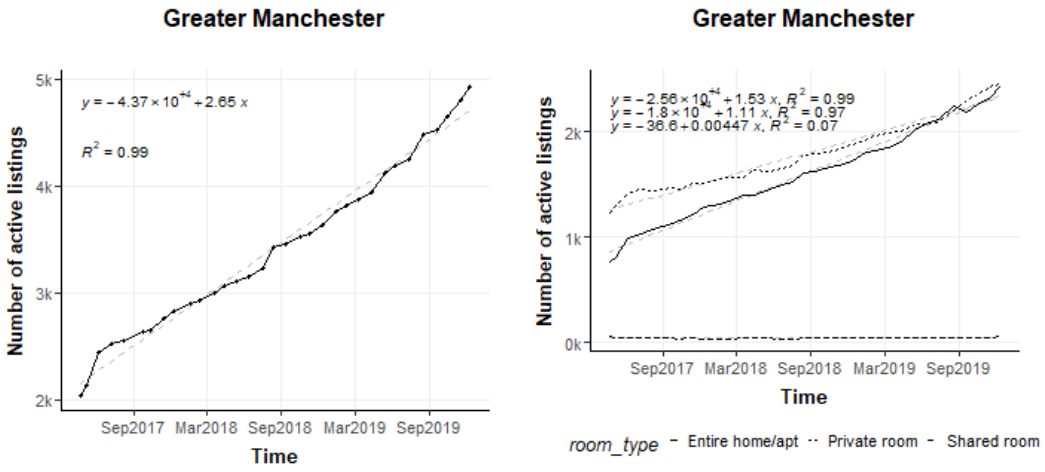
The geographic area in cluster 3 is a medium-growth type of LSOAs with moderate volume and fast growth rate, and the growth curve from the centroids of this cluster shows fluctuating and fast growth. The number of listings in this cluster grew in the range of 0 to 105 listings. The geographical distribution of this cluster shows that medium to fast growing LSOAs are mainly located in the suburbs outside the city centre, mostly south of Inner London, typically in Brentford, Beckton, Bounds Green, Dundonald, etc.

- Slow growth

The geographic area in cluster 1 is a low growth type, with a small volume and a slow growth rate. From the centroids of this cluster, the growth curve does not rise in the first 20 months, reaching 30 listings at the end of the study timeframe. The increase in the number of listings in this cluster ranges from 0 to 125 listings. In terms of the geographical distribution of this cluster, the low growth rate of LSOAs is mainly located in distant suburban areas, typically in most of the west such as Hillingdon, Harrow, and Havering, Bexley in the east, Enfield in the north, and Croydon in the south.

5.2.2 Temporal dynamic characteristics of Airbnb in Greater Manchester

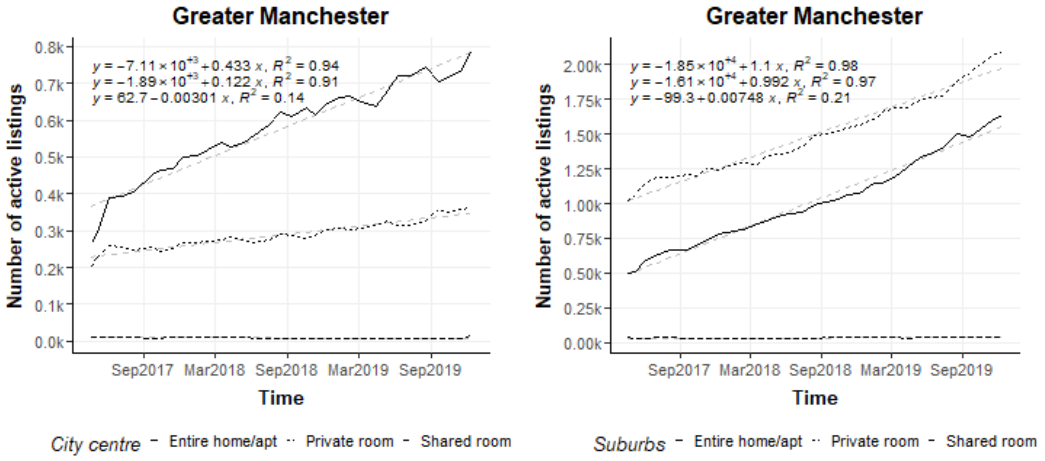
The growth curve of the number of Airbnb listings in Greater Manchester shows that, visually, the number of Airbnb listings across Manchester has generally trended upwards over the last few years of the study timeframe (Figure 5-10), with active listings growing from 2,046 in April 2017 to 4,935 in December 2019, with a fitted average growth rate of up to 79.5 per month, with the growth rate being linear over the study period. From Airbnb's room type statistics in Manchester, the main room types of Manchester are entire home and private room. The number of entire home listings is the largest and fastest growing of the three, with an average of 45.9 entire home listings added per month in Greater Manchester; private rooms also grew very quickly, with an average increase of 33.3 per month, and the number of private room listings is very close to the number of entire home listings until March 2018; shared rooms only averaged 50 listings, with flatlining growth trend, making a minor part of the offerings.



Data source: Inside Airbnb

Figure 5-10 The growth trend of Airbnb listings with linear fitting of Greater Manchester. (Own elaboration)

Looking at the core-periphery (Figure 5-11), the number of Airbnb listings in Manchester city centre from 2017 to 2019 showed an upward trend, growing from 480 at the beginning of the study period to 1,160 at the end, with a linear fitted growth rate of 17 listings added here each month. Looking at room types of Airbnb in the core area, entire home listings is the most numerous of the three types and the fastest growing, adding an average of 13 entire home listings per month in the city centre; private rooms grew slightly more slowly, adding only around 4 per month with an average level of around 280; shared rooms have only a single-digit quantity, with a peak of 18.



Data source: Inside Airbnb

Figure 5-11 The growth trend of Airbnb listings with linear fitting of core-periphery of Greater Manchester. (Own elaboration)

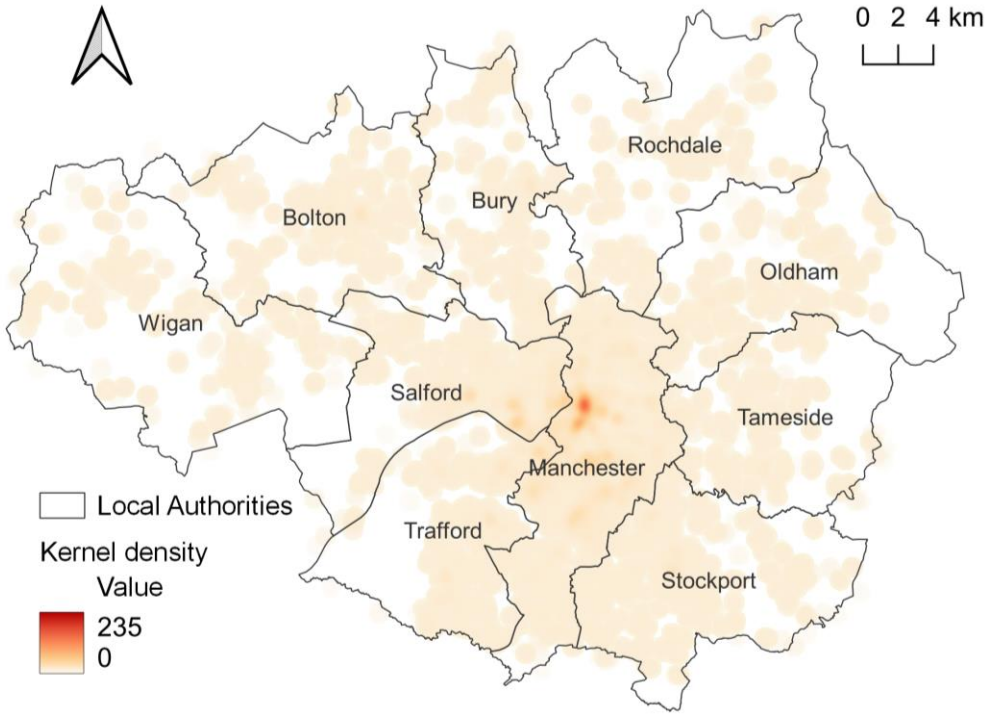
Many Airbnb products have spread to the wider suburban area, growing from 498 at the beginning of the study period to 1,641 at the end, an average of 33 listings added per month in the suburbs, with the number of listings in the suburbs being around 2 times higher than those in the city centre. Looking at room types of Airbnb in the suburban area, entire home listings are also the most abundant and most rapidly growing of the three, adding an average of 33 entire home listings per month in the suburbs; private rooms are also growing at a decent rate, adding an average of 30 per month. In fact, the growth rate of the number of private rooms kept remarkably close to that of entire home listings; the number of shared rooms has remained at an average of 30, an extremely gentle upward trend compared to the other two room types, with few offerings.

5.2.2.1 The spatial pattern of Airbnb in Greater Manchester

According to the statistical summary (Table 5-2), as of the close of 2019, there were 4,935 active Airbnb listings within Greater Manchester. Upon analysing 4,835 LSOA statistical units, it was found that short-term rentals were present in 886 LSOAs, representing approximately half of the total statistical units within Greater Manchester. The P2P accommodation units mainly appeared in a few vibrant central boroughs, showing the characteristic of clustering (see Figure 5-12). The areas with the highest kernel density values are in Northern Quarter, Salford Quays and the areas surrounding Manchester Oxford Road Station and Rusholme. Northern Quarter is a hotbed for creative and digital businesses (Bennison, Warnaby, & Medway, 2007), while Salford Quays has diverse cultural and entertainment offerings (Bäing & Wong, 2018), including MediaCityUK, The Lowry, Imperial War Museum North and Watersports Centre. In proximity to Manchester Oxford Road Station and Rusholme, one can find a wealth of cultural, educational, and scientific institutions such as the Palace Theatre, the Whitworth Art Gallery, the University of Manchester, and the Manchester Museum. These areas, with their varied attractions and suitability as holiday destinations, draw a wide range of accommodation options.

Table 5-2 Descriptive statistical summary of Airbnb listings in Greater Manchester.

Room type		Entire home	Private room	Shared room	Total	Total number of statistical units
Greater Manchester	Number of listings	2426	2452	57	4935	—
	Number of LSOA with listings	566	702	38	886	1673
	Percent of LSOA with listings	33.83%	41.96%	2.27%	52.96%	—



Data source: Inside Airbnb

Figure 5-12 Kernel density estimation of Airbnb listings spatial distribution in Greater Manchester. (Own elaboration)

In general, the distribution of Airbnb listings in Manchester has a spatial pattern of “primary core and various subordinates” within a 3km radius of the city centre. It is worth noting that there are few hotspots in the outer boroughs.

In Greater Manchester, it is revealed that 2,426 active Airbnb listings are entire home products. These offerings were distributed across 566 LSOAs, suggesting that 33.83% of the studied statistical units contained at least one 'entire home' accommodation, the remaining 66.17% of LSOAs under investigation lacked any such listings. The prevalence of entire home listings, accounting for over half of the total Airbnb, suggests that these offerings form the high-density core of Airbnb's presence in Manchester.

In contrast, the study identified 2,452 active private room Airbnb accommodations, dispersed across 702 LSOAs. This indicates that approximately 41.96% of the examined statistical units contained at least one private room Airbnb offering. Despite making up around half of all listings, the distribution of private room accommodations significantly diverges from that of entire home offerings. Geographically, private room accommodations are notably concentrated in areas such as the Northern Quarter and Rusholme. In the case of Rusholme, this may be attributed to the area's relatively deprived situation, leading households to rent out spare rooms as a means of supplementing their income. The distinct spatial patterns of these two types of accommodations underscore the diverse socio-economic dynamics shaping Airbnb's presence in Greater Manchester.

Through the analysis, the clustering clearly illustrates the spatial distribution of the growth pattern throughout Greater Manchester (Figure 5-13). These trends were segmented into three clusters: rapid growth, medium growth, and slow growth.

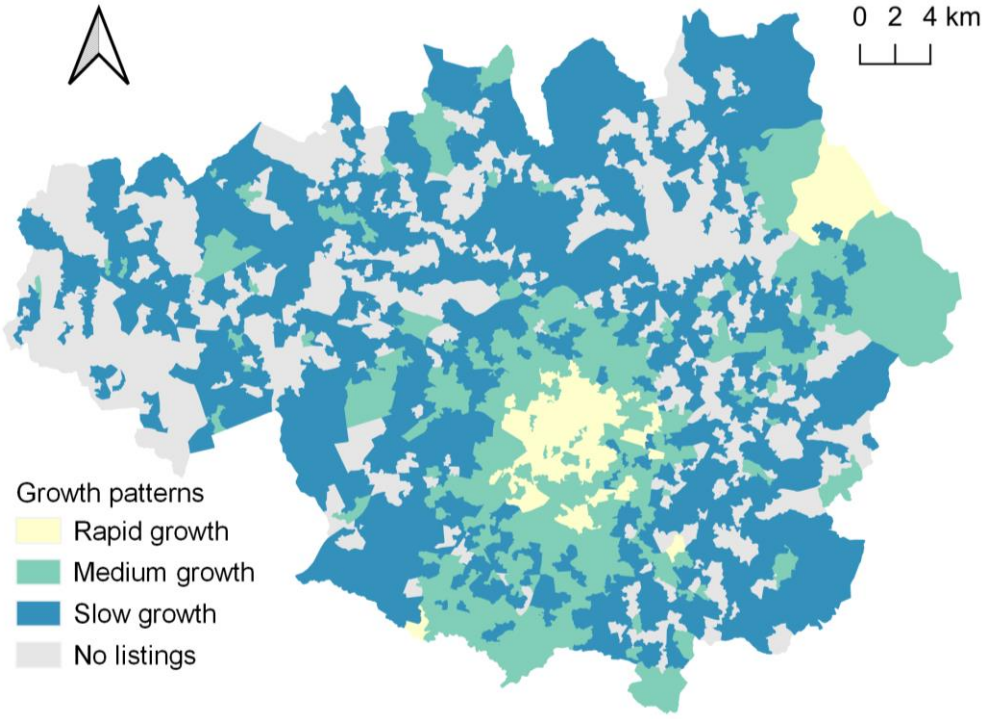


Figure 5-13 The spatial distribution of growth pattern clustering. (Own elaboration)

- Rapid growth

The rapid-growth areas are the largest, fastest growing and most volatile LSOAs for Airbnb in Manchester, and there is a clear upward trend from the centroids of the cluster 3 (see Appendix Figure A-2), which has a growth range of 2-23 listings, with each rapid rise followed by a rapid fall. The actual growth in this cluster spans a wide range of 0 to 150 listings, with some statistical units showing multiples of growth compared to the beginning of the period. The geographical distribution of this cluster shows that the high growth of LSOAs is concentrated in the city centre with a 6km radius, from The Quays to Openshaw and from Cheetham Hill to Didsbury, which is in line with the urban regeneration policies and the development of transport infrastructure in the area.

- Medium growth

The geographic area in cluster 2 is a medium-growth type of LSOAs with moderate volume and fast growth rate, and the growth curve from the centroids of this cluster shows fluctuating and fast growth. The number of listings in this cluster grew in the range of 0 to 15 listings. The geographical distribution of this cluster shows that the medium to fast growing LSOAs mainly extend outwards

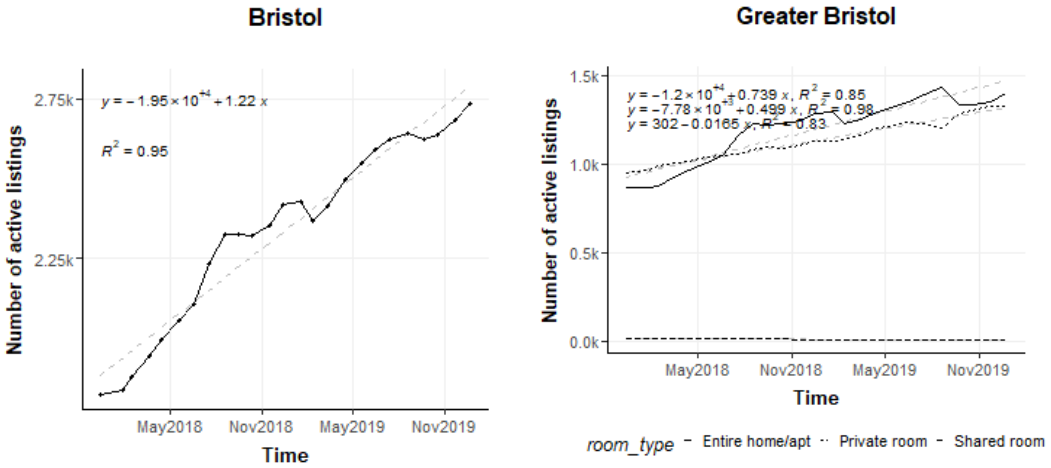
from the rapid growth core, mostly south of Manchester and areas in Salford and Trafford which are close to Manchester.

- Slow growth

The geographic area in cluster 1 is a slow growth type, with a small volume and a slow growth rate. From the centroids of this cluster, the growth curve rises to 2 in the first 20 months, dropping to 0 at the end of the study timeframe. The increase in the number of listings in this cluster ranges from 0 to 8 listings. In terms of the geographical distribution of this cluster, the low growth rate of LSOAs mainly covers most of the outer boroughs.

5.2.3 Temporal dynamic characteristics of Airbnb in Bristol

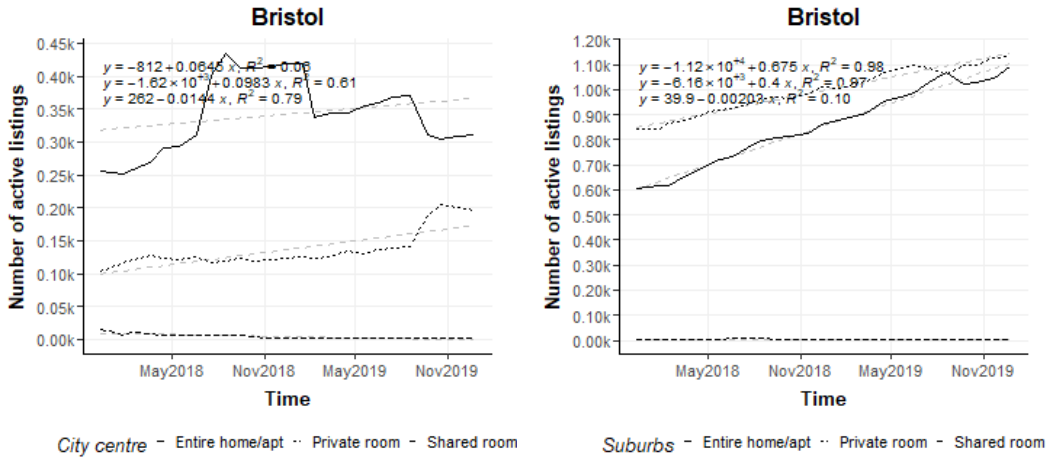
The growth trajectory of Airbnb listings across various regions of Bristol indicates a consistent upward trend over the study period. Active listings saw a substantial increase, rising from 1,826 in December 2017 to 2,734 in December 2019. The data reveals an average growth rate of up to 36.6 listings per month. Notably, the growth rate remained largely linear throughout the study period (Figure 5-14). From Airbnb's room type statistics in Bristol, the main room types of Bristol are entire home and private room. The number of entire home listings is the fastest growing of the three, with an average of 22.2 entire home listings added per month in Bristol; private rooms also grew very quickly, with an average increase of 15 per month, and the number of private room listings is very close to the number of entire home listings in November 2019; shared rooms only averaged 50 listings, with a flat trend, making a minor part of the offerings.



Data source: Inside Airbnb

Figure 5-14 The growth trend of Airbnb listings with linear fitting of Bristol. (Own elaboration)

Looking at the core-periphery (Figure 5-15), the number of Airbnb listings in Bristol city centre from 2017 to 2019 showed an upward trend, growing from 374 at the beginning of the study period to 508 at the end, with a linear fitted growth rate of 4.44 listings added here each month. Looking at room types of Airbnb in the core area, entire home listings is the most numerous of the three types and the fastest growing, showing a rapid growth in the early stage while stepped down thereafter in the city centre; private rooms grew slightly more slowly, adding only around 2.9 per month with an average level of around 280; shared rooms even showed a downward trend.



Data source: Inside Airbnb

Figure 5-15 The growth trend of Airbnb listings with linear fitting of core-periphery of Bristol. (Own elaboration)

The distribution of Airbnb has demonstrated a spread from the inner to the outer core areas, growing from 1,452 at the beginning of the study period to 2,226 at the end, an average of 32.1 listings added per month in the suburbs, with the number of listings in the outer core areas being around 7 times higher than those in the city centre. Looking at room types of Airbnb in the suburban area, entire home listings are the most rapidly growing of the three, adding an average of 20.25 entire homes per month in the suburbs; private rooms tend to be the most numerous growing at a decent rate, adding an average of 12 per month; the shared rooms have few offerings with an extremely flat trend compared to the other two room types.

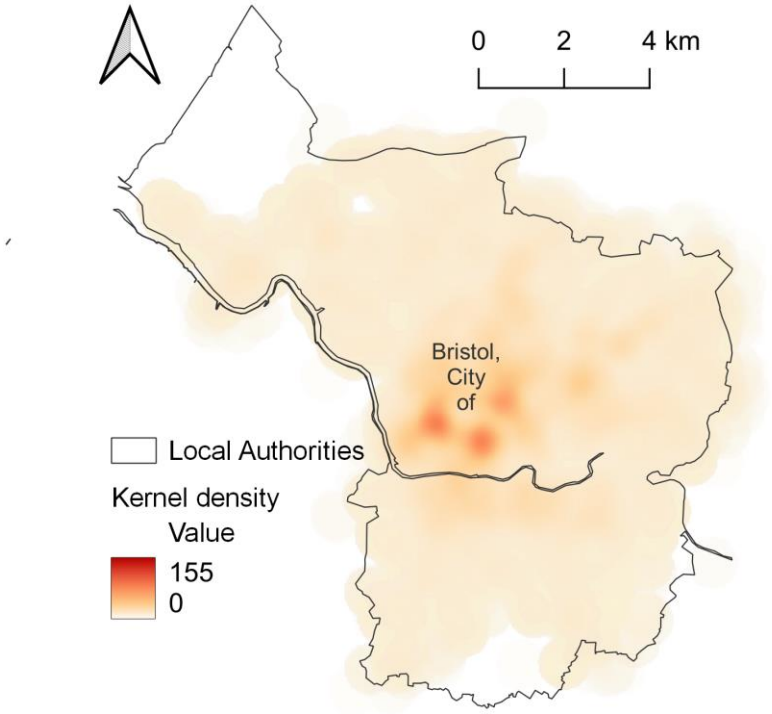
5.2.3.1 The spatial pattern of Airbnb in Bristol

According to the statistical summary (Table 5-3), as of the end of 2019, there were 2,736 active Airbnb listings within Bristol. Upon analysing 263 LSOA statistical units, it was found that P2P short-term rentals were present in 236 LSOAs, representing approximately 90% of the total statistical units within Bristol.

The P2P accommodation units mainly appeared in a few tourists' attractive neighbourhoods (Figure 5-16). The areas with the highest kernel density values are in St Paul, Brandon Hill and Clifton Suspension Bridge. These areas are either well known tourist destinations or have beautiful views of the riverbanks, thus generating a large supply of accommodation.

Table 5-3 Descriptive statistical summary of Airbnb listings in Bristol.

Room type		Entire home	Private room	Shared room	Total	Total number of statistical units
Bristol	Number of listings	1401	1332	3	2736	—
	Number of LSOA with listings	204	222	3	236	263
	Percent of LSOA with listings	77.57%	84.41%	1.14%	89.73%	—



Data source: Inside Airbnb

Figure 5-16 Kernel density estimation of Airbnb listings spatial distribution in Bristol. (Own elaboration)

In general, the distribution of Airbnb listings in Bristol has a spatial pattern of "Node-and-Link Development" (Fang et al., 2020) covering most of the city centre areas. There are few hotspots in the outer areas.

In Bristol, it is revealed that 1,401 active Airbnb listings are entire home products. These offerings were distributed across 204 LSOAs, suggesting that 77.57% of the studied statistical units contained at least one entire home accommodation. The prevalence of entire home listings, accounting for over half

of the total Airbnb, suggests that these offerings form the high-density core of Airbnb's presence in Bristol city centre.

In contrast, the study identified 1,332 active private room Airbnb accommodations, dispersed across 222 LSOAs. This indicates that approximately 84.41% of the examined statistical units contained at least one private room Airbnb offering. Despite making up around half of all listings, the distribution of private room accommodations does not have a significant divergence from that of entire home offerings. Private room accommodations are also concentrated in the city centre and the South side of river Avon. The similar spatial patterns of these two types of accommodations underscore the uniform preferences shaping Airbnb's presence in Bristol.

The analysis yielded the clustering that represents the spatial distribution of the growth pattern across Bristol (Figure 5-17). These patterns were categorised into three clusters: rapid growth, medium growth, and slow growth.

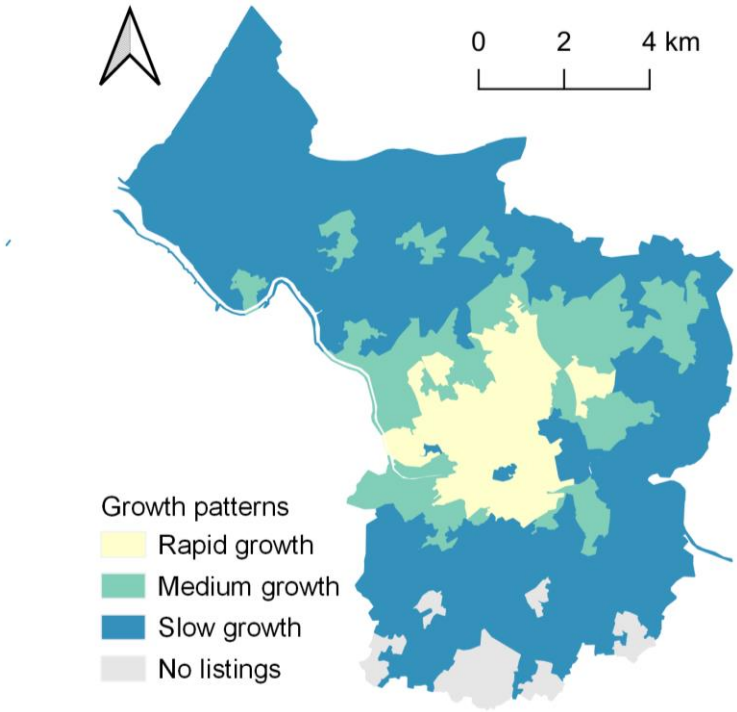


Figure 5-17 The spatial distribution of growth pattern clustering. (Own elaboration)

- Rapid growth

The rapid-growth areas are the fastest growing and most volatile LSOAs for Airbnb in Bristol, and there is a clear upward trend from the centroids of the cluster 2 (see Appendix Figure A-3), which has a range of 17-36 listings, with a sustained growth. The actual growth in this cluster spans a wide range of 5 to 120 listings, with some statistical units showing multiples of growth compared to the beginning of the period. The geographical distribution of this cluster shows that

the high growth of LSOAs is concentrated in the city centre with a 3km radius, from the Clifton Suspension Bridge to Easton and from Bishopston to the Victoria Park, which is exactly the broader central area attracting most businesses and visitors.

- Medium growth

The geographic area in cluster 3 is a medium-growth type of LSOAs with moderate volume and fluctuating rise, and the growth curve from the centroids of this cluster shows fluctuating and fast growth averaging from 8 to 16. Overall, the number of listings in this cluster grew in the range of 0 to 25 listings. The geographical distribution of this cluster shows that the medium to fast growing LSOAs mainly extend outwards from the rapid growth core, mostly towards northwest and northeast.

- Slow growth

The geographic area in cluster 1 is a slow growth type, with a small volume and a slow growth rate. From the centroids of this cluster, the growth curve rises to 5 in the first 20 months, and then drops to 2 at the end of the study timeframe. The increase in the number of listings in this cluster ranges from 0 to 8 listings. In terms of the geographical distribution of this cluster, the low growth rate of LSOAs mainly covers most of the outer areas.

5.3 Rent gap opening and closing

5.3.1 Greater London

(1) As mentioned in the methodology section, multiple indicators are used to measure the size of rent gaps from different angles. First, %Potential P2P Revenue measures the size of the rent gap opened up by the overall potential ground rent of the Airbnb sector relative to the actual ground rent of the long-term rental sector.

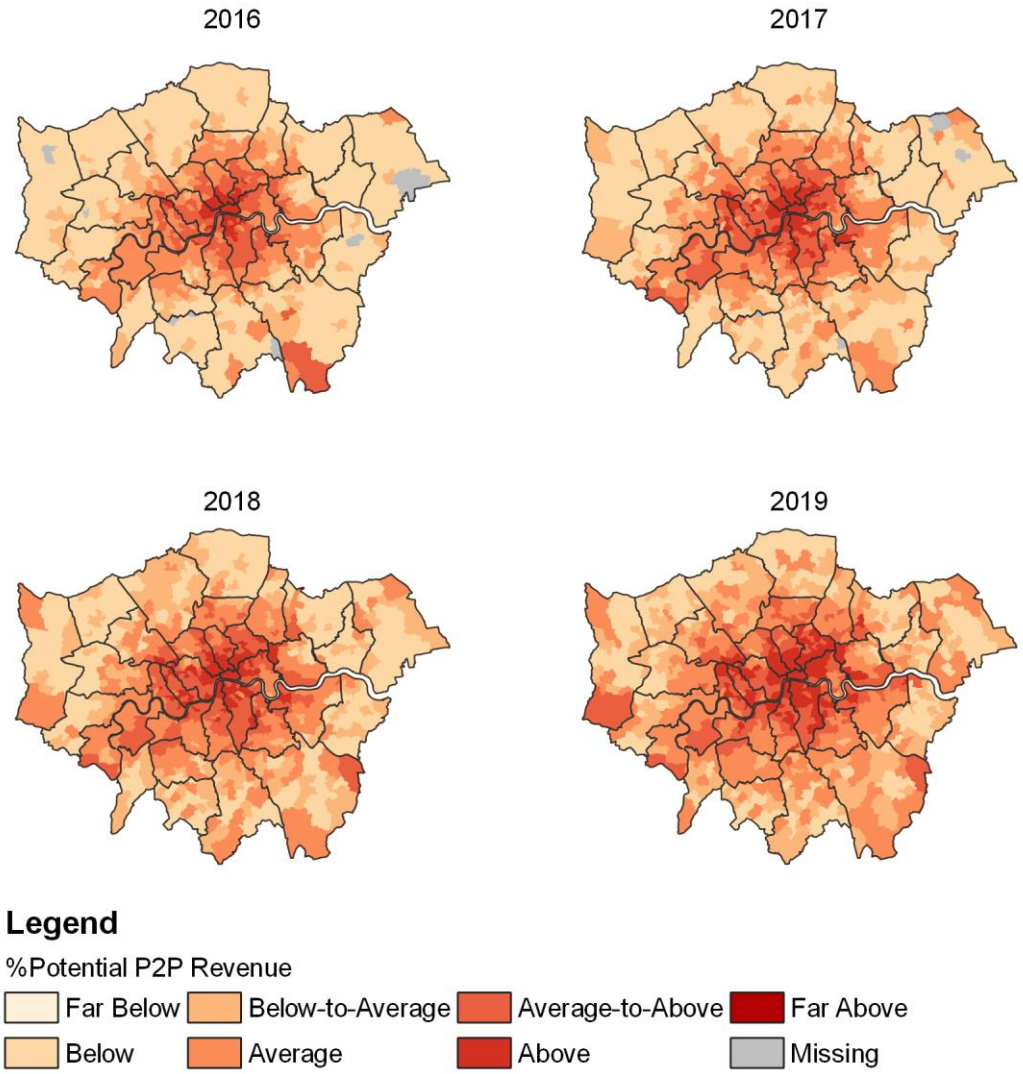


Figure 5-18 The rent gap measured by percent of potential P2P revenue in Greater London. (Own elaboration)

The Figure 5-18 shows the spatial variation of this indicator from 2016 to 2019. It indicates that in 2016, when the sharing economy had just started, Airbnb as a new source of housing income had an impact in the City of London, Camden, Islington, and Kensington, and some communities had entered Above level. These are all boroughs located within Central London, which is the innermost part of London characterised by its high-density built environment, high land values, elevated daytime population, and concentration of significant organisations and facilities.

In 2017, the overall revenue levels of several Airbnb properties in the centre of London had previously reached Above, with the community expanding to surrounding areas, stretching from Camden to Westminster, from Islington to Hackney. Southwark also added several neighbourhoods that transitioned from moderate to high gentrification. Moderate gentrification areas also spread to the surrounding areas, covering most of Central London.

In 2018 compared to the previous year, the number of Above level neighbourhoods did not increase significantly. Some Above level areas became Average-to-Above, while some neighbouring Average-to-Above neighbourhoods became Above level. In addition, the number of Average-to-Above neighbourhoods increased, further strengthening the trend of contiguous areas, but the growth rate slowed down. These data indicate that the gentrification process in Greater London has temporarily entered a relatively stable stage. The degree of gentrification has not deepened further but has expanded from within London to the outside. This also means that short-term rentals activities like Airbnb have permeated into various communities in central London and more people are experiencing the potential rent increases brought by housing sharing.

In 2019, after a relatively stable period the previous year, gentrification caused by Airbnb deepened further, with Airbnb showing significant growth trends both in quantity and profitability, widening the rent gap measured by neighbourhood median income. In neighbourhoods like Westminster, Camden and Kensington that have reached Above level, Airbnb revenue share reached 90%. Due to their unique appeal and large foreign population, housing sharing can generate huge profits in these areas where property values are extremely high. Airbnb's aggressive expansion in these already Above level neighbourhoods further exacerbated gentrification. The number of Above level neighbourhoods also increased and spread to Islington, Wandsworth, Lewisham and even London suburbs like Bromley and Croydon influenced by the airport or countryside leisure tourism, entering a highly gentrified stage.

(2) The %Professional Hosts Revenue is a measure of the potential ground rent for Airbnb's entire home rentals, relative to the actual ground rent for the long-term rental sector and reflects the gap between the returns of the two markets, also known as the rent gap.

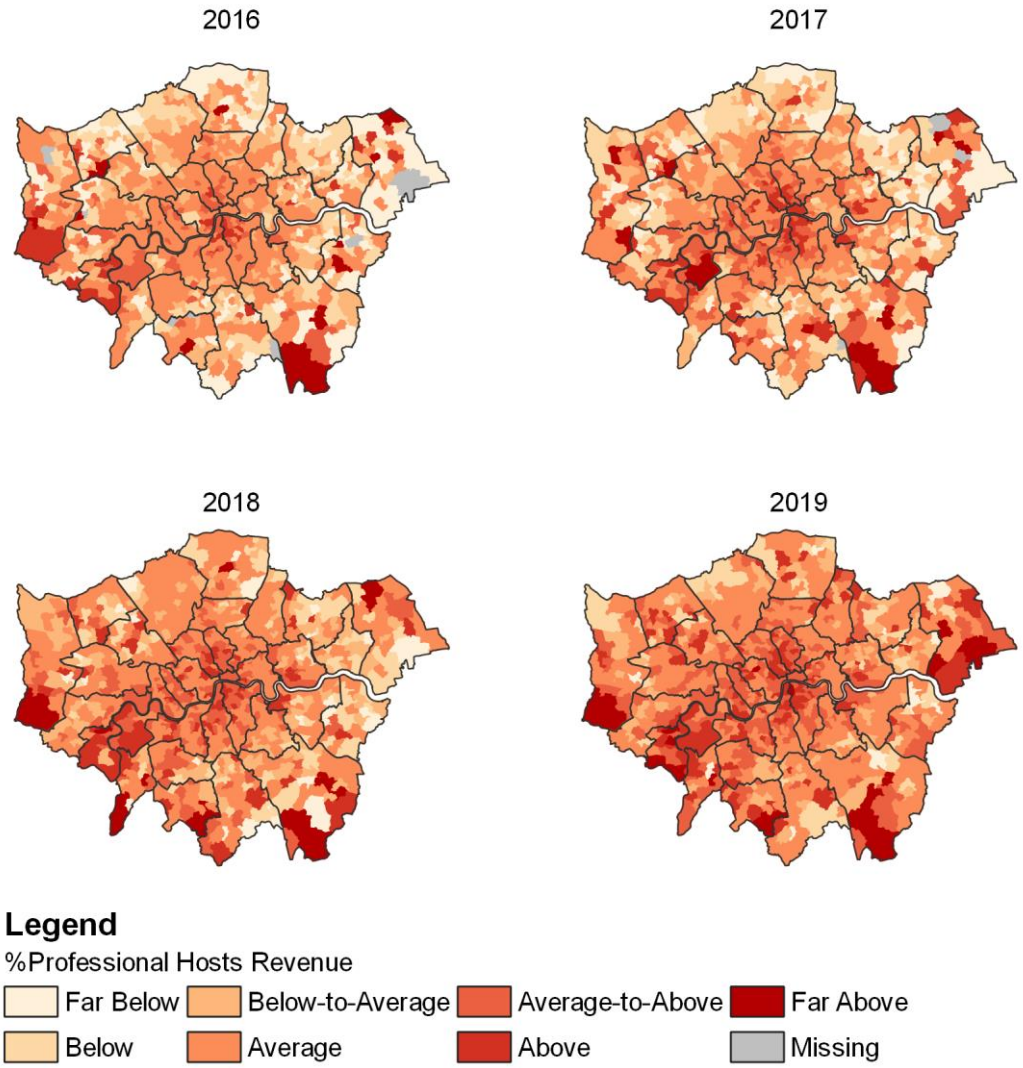


Figure 5-19 The rent gap measured by percent of professional hosts revenue in Greater London. (Own elaboration)

By converting units into exclusive entire home short-term rentals, it creates incentives for landlords to gentrify their properties and reflects the performance of professional landlords. Figure 5-19 shows the spatial changes of this index from 2016 to 2020, which are slightly different from the results of the potential total P2P rental revenue index. It indicates that in 2016, neighbourhoods of Far Above are usually found in distant suburbs. In a few areas such as Lambeth and Southwark in the city centre and Richmond upon Thames, Hillingdon and Havering in the suburbs, Airbnb short-term rentals generated more revenue than long-term rentals when rented as an entire home. These areas either have cultural landscapes in the city centre or natural scenery in the suburbs that are suitable for entire home short-term rentals. In the Above level neighbourhoods, many Average-to-Above level neighbourhoods at risk of gentrification have grown around them. Overall, these Airbnb highly professional neighbourhoods are still clustered along the Thames River or in areas with good natural environments.

In 2017, Above level neighbourhoods in Central London have expanded to the north and south. Suburbs such as Harrow and Bromley have also added several Above level neighbourhoods. The percentage of Above level vulnerable areas caused by Airbnb taking away housing resources for entire home rentals is not very high and is relatively scattered, indicating that gentrification caused by Airbnb is not a widespread phenomenon in London.

In 2018, the trend of entire homes being converted into short-term rentals to generate revenue slowed down, and the number of Above level areas changed in the city centre but increased in Richmond upon Thames. In addition, the number of Average-to-Above areas also showed a slightly slowed trend, increasing by 46 London. This also reflects the slowdown in gentrification and loss of housing resources caused by Airbnb in London that year. This is partly due to the increasingly fierce competition from other vacation rental companies such as VRBO and HomeAway (Hajibaba & Dolnicar, 2018), and the slowing global growth of Airbnb, as well as the regulatory challenges and restrictions in the P2P short-term rental sector.

In 2019, after experiencing policy restrictions in the previous year, local gentrification caused by entire home rentals on Airbnb showed a trend of expansion again, as the potential ground rent for entire home rentals on Airbnb relative to the actual ground rent for long-term rentals was opened. The number of Far Above level areas did not increase significantly, but the number of Above level and Average-to-Above level neighbourhoods increased significantly, rising by 43 and 49 respectively. The spatial distribution of these areas has spread to regions such as Hillingdon and Kingston upon Thames, as more and more homes are used for entire home short-term rentals, leading to an increase in median entire home Airbnb revenue. Overall, the spatial distribution of opened rent gap areas is still mainly in Central London and Richmond upon Thames.

(3) The Revenue Performance indicator measures whether the profitability of entire short-term properties in a region outperforms long-term rentals, suggesting whether more landlords might exploit the opened rent gap by converting property use. When a community's total rental income percentage earned through Airbnb is significantly higher than surrounding areas, it doesn't necessarily confirm that the rent gap between Airbnb units and long-term leases has actually narrowed. Instead, this metric more realistically reflects whether the area attracts more landlords to use the entire property for short-term use.

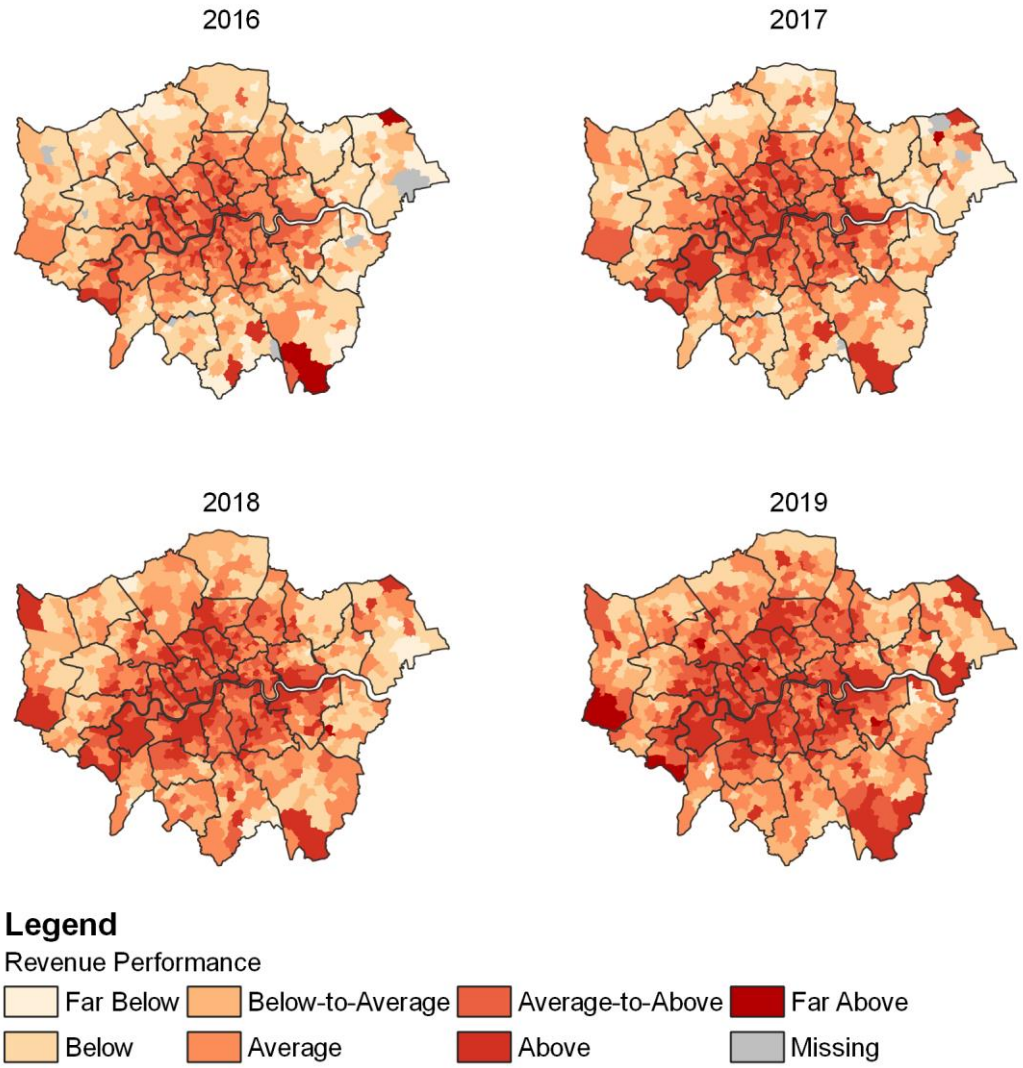


Figure 5-20 The rent gap measured by percent of revenue performance in Greater London. (Own elaboration)

Figure 5-20 depicts the spatial changes of this indicator from 2016 to 2020 in London, presenting different results compared to the first two indicators. In 2016, regions with a Far Above rating only appeared in Bromley and Havering. There were 52 areas with an Above rating, mainly in Westminster, Kensington, Hammersmith, Islington, Southwark, and Lewisham. These high Revenue Performance areas were still clustered along the Thames or in high-value property areas. There were 173 Average-to-Above areas, with each central borough having an average of 10 MSOAs within this range.

In 2017, neighbourhoods in Greater London with a Far Above Revenue Performance rating changed to two different locations. Neighbourhoods with an Above rating doubled from the previous year, indicating that more communities had further opened up due to a vast market space rental gap. The number of Average-to-Above added 23 on the original basis, suggesting that Airbnb, as a means of financialising idle housing, gradually spread out, extending to almost 90% of

boroughs. This year marked the sprouting of Airbnb, with some people operating short-term rentals as a business through the Airbnb platform, rather than as a way to share their houses or apartments.

In 2018, the London city government strengthened its supervision and enforcement on short-term rentals, cracking down on the behaviour of using entire idle houses for short-term rentals (Just Planning, 2019). The revenue growth rate of entire houses in central London dropped by about 6.9% in 2018. There was only one Far Above area. The number of Above communities increased to 192, mainly expanding from Central London to the southwest and east. The growth rate of the number of Average-to-Above communities slowed down, increasing by 15, with 31 out of 33 boroughs having communities reaching this level. Due to the presence of regulation, some Far Above level communities disappeared. However, overall, the number of communities above the average level is still increasing. This indicates that despite the impact of regulatory measures on the short-term rental market, the market still has strong adaptability.

In 2019, despite the policy restrictions of the previous year, the demand for short-term rentals still existed, and some people continued to operate this business by finding loopholes. In 2019, the Revenue Performance indicator in central London showed that the proportion of Airbnb income was on average about 26.75% higher than the proportion of Airbnb adverts, and the growth in revenue performance further opened the rental gap. The number of Far Above communities significantly increased to six, and the number of Above communities saw a significant increase from 192 in 2018 to 256 in 2019. The spatial distribution of these communities, apart from being located in Central London, expanded to boroughs in the northeast. The number of Average-to-Above communities increased from 195 to 203, covering all boroughs. Overall, the spatial distribution of communities with an expanded rent gap has spread to most parts of London, forming a contiguous development situation. Market participants are still seeking new methods and strategies to cope with policy restrictions and challenges.

5.3.2 Greater Manchester

(1) The Figure 5-21 presented illustrates the spatial variation of the %Potential P2P Revenue indicator in Greater Manchester from 2017 to 2019. It indicates that the situation in Manchester is more moderate compared to London, and no community has reached the Far Above level. In 2017, 16 neighbourhoods reached the Above level, with 10 primarily located in central Manchester's Piccadilly and Old Trafford areas. These areas have a good commercial and cultural atmosphere and a diverse population. The other four, such as Cheadle, Bramhall, and Saddleworth, are in the suburbs with many large and expensive homes and picturesque countryside. The area may lack traditional hotels or accommodations, which may lead to an increase in demand for Airbnb listings, resulting in short-

term rental income far exceeding long-term rental income. There were 34 neighbourhoods at the Average-to-Above level, which were mainly located around the Above-level neighbourhoods in central Manchester and eastern suburbs.

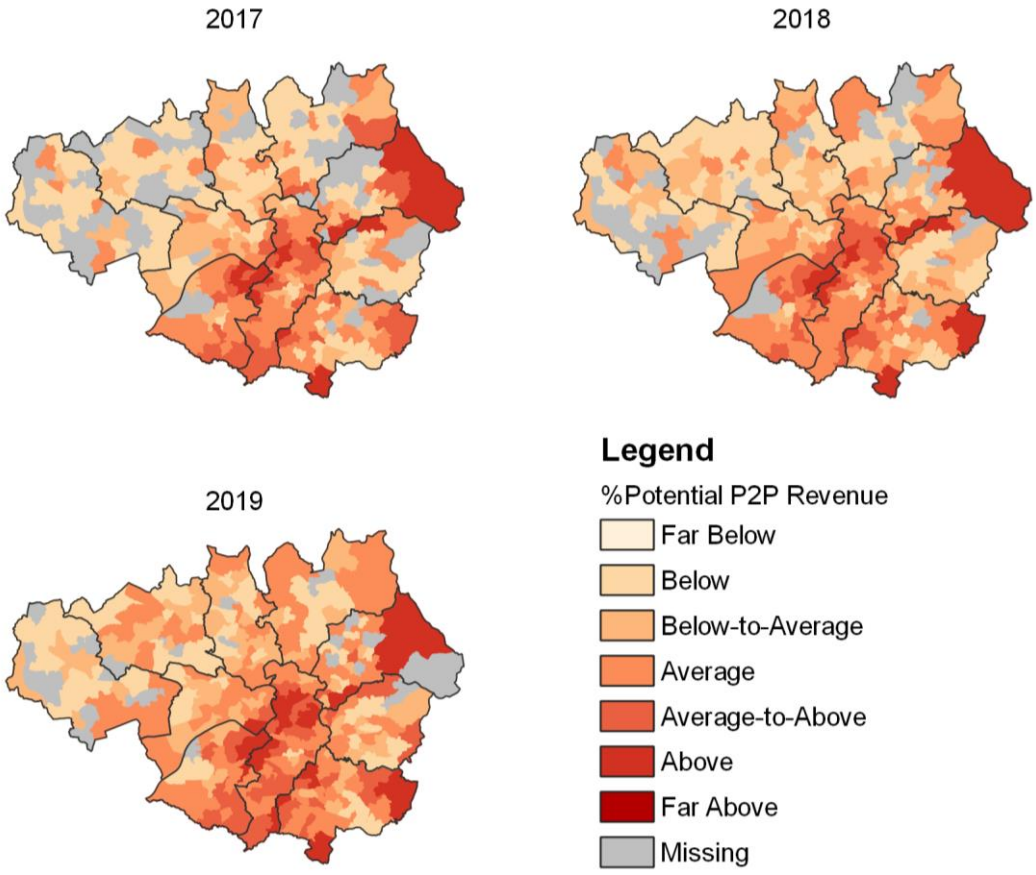


Figure 5-21 The rent gap measured by percent of potential P2P revenue in Greater Manchester. (Own elaboration)

In 2018, there were 19 neighbourhoods at the Above level, with four new neighbourhoods located in Old Trafford, Oldham, and Stockport. There were 32 neighbourhoods at the Average-to-Above level, an increase of one, and at this time, neighbourhoods at this level were mainly located in the Manchester and Trafford boroughs. Airbnb's growth in Manchester was very slow in 2018 due to changes in the global short-term rental environment, and people's attitudes towards Airbnb and other short-term rental platforms became more cautious.

In 2019, there were 30 neighbourhoods at the Above level, with a faster growth rate than the previous year. Many neighbourhoods in Old Trafford, Oldham, and Stockport further upgraded from Average-to-Above to Above level, and there were also neighbourhoods such as Marple on the edge of the Peak District National Park. The number of neighbourhoods at the Average-to-Above level increased by 10, and their spatial distribution changed compared to the previous year, but it was more similar to the distribution pattern in 2017. They were concentrated in the eastern and southern boroughs of Manchester, while there were almost no neighbourhoods

with Airbnb revenue ratios higher than the average level in the western and northern boroughs. The proportion of neighbourhoods with Airbnb revenue ratios higher than the Manchester average in 2019 was less than 20.8%, indicating that the breadth of Airbnb penetration throughout Manchester was limited.

(2) Figure 5-22 displays the spatial variation of the %Professional Hosts Revenue index from 2017 to 2019, which differs slightly from the results of the %Potential P2P Revenue indicator. It indicates that in 2017, areas with a high proportion of professional hosts' revenue at the 'Far Above' level were usually located in the suburbs. In suburbs such as Wigan, Bolton, and Rochdale, Airbnb generated more income than long-term rentals for the entire property. These suburbs may be popular tourist destinations and have abundant entire house listings, making short-term rental of their entire house more profitable than long-term rental of the same property. There were only 26 neighbourhoods at the Above level, most of them are located in the suburbs. There were 25 neighbourhoods at the Average-to-Above level, of which about 52% of neighbourhoods were located in Manchester, Trafford, and Salford.

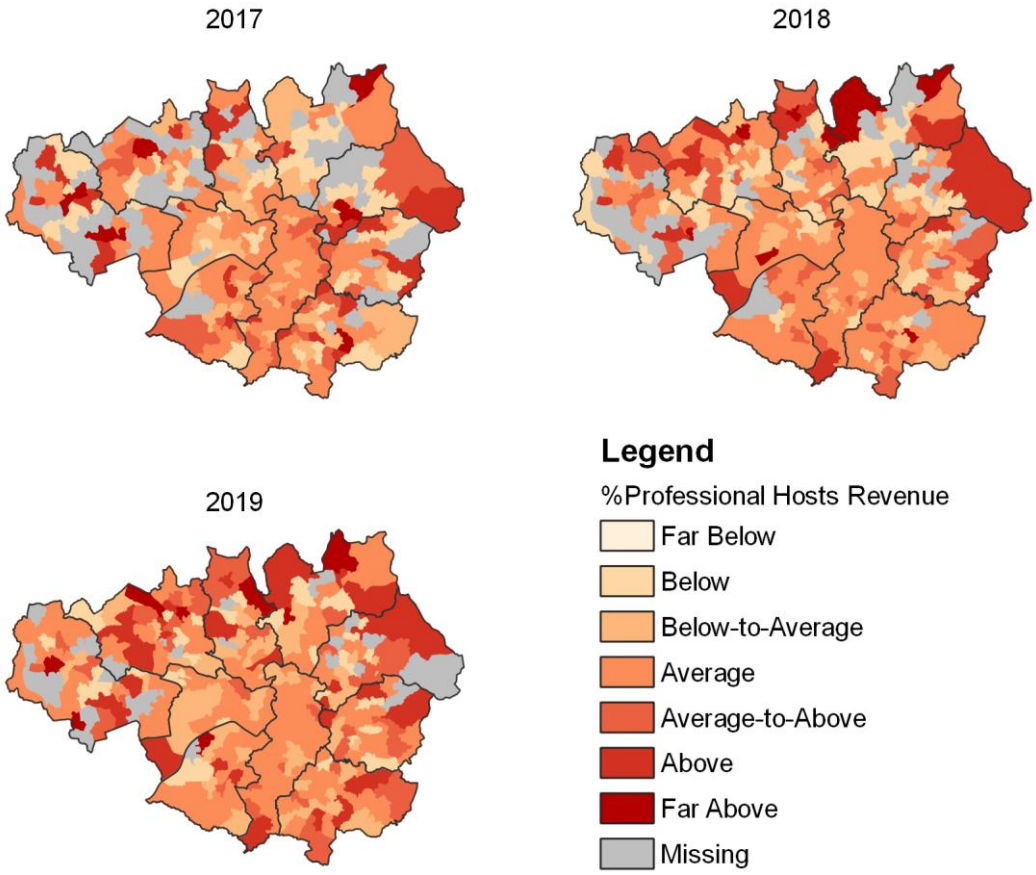


Figure 5-22 The rent gap measured by percent of professional hosts revenue in Greater Manchester. (Own elaboration)

In 2018, the number of areas in Manchester at the Far Above level decreased to 8. There were only 17 neighbourhoods at the Above level, and the number of neighbourhoods at the Average-to-Above level increased by 9. Due to changes in the policy environment, the trend of transforming entire houses into short-term rentals for revenue slowed down, and areas with revenue ratios higher than the Average level in Manchester changed.

In 2019, after experiencing policy restrictions in the previous year, the number of areas in Manchester at the Far Above level increased back to 9. There were 34 neighbourhoods at the Above level, but the number of neighbourhoods at the Average-to-Above level also remained at 36. These areas mainly spread in the suburbs outside the city centre, and more and more houses were used for short-term rental of entire houses, leading to an increase in gentrification. Overall, the areas where entire houses are being eroded by professional hosts are still in remote suburbs.

(3) Figure 5-23 displays the spatial variation of the Revenue Performance indicator in Manchester from 2017 to 2019, which differs from the results of the previous two indicators. It indicates that in 2017, there were 5 neighbourhoods at the Far Above level, 4 of 5 located in the suburbs about 10km from the Manchester city centre. There were 25 neighbourhoods at the Above level, half of which are close to the city centre and half in the suburbs. There were 58 neighbourhoods at the Average-to-Above level, which were relatively dispersed, appearing not only in the city centre but also in the eastern and southern suburbs.

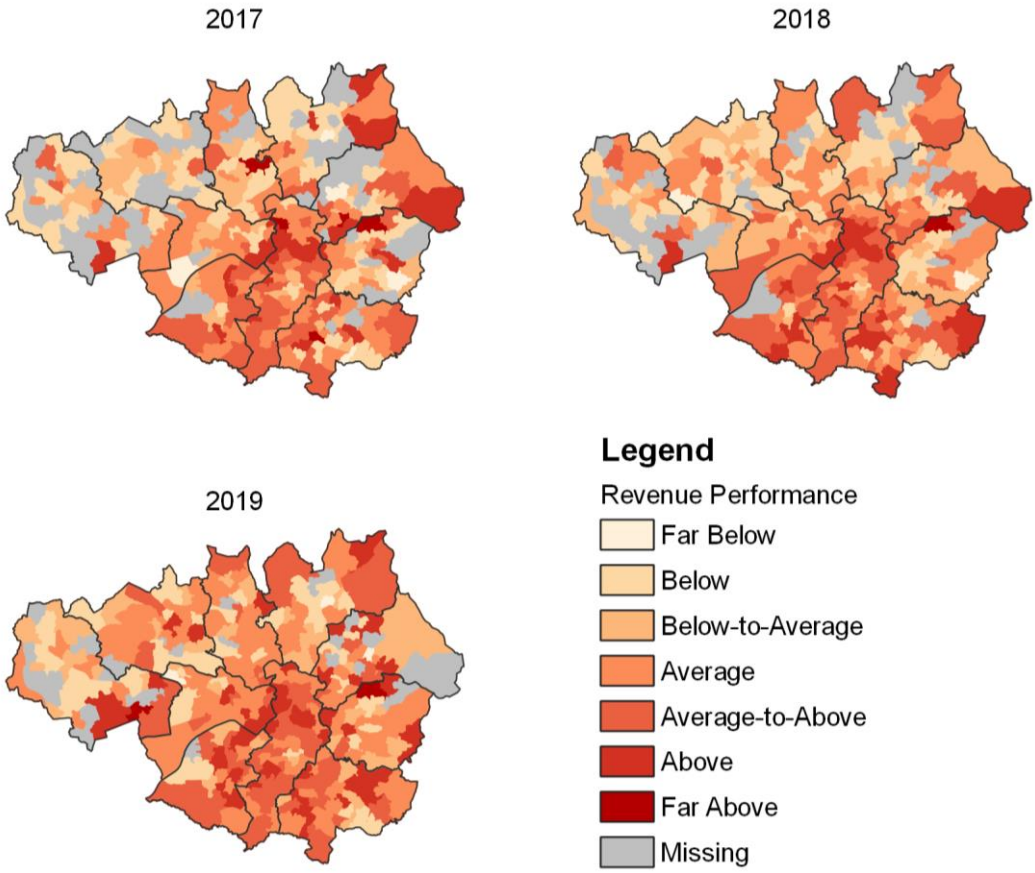


Figure 5-23 The rent gap measured by percent of revenue performance in Greater Manchester. (Own elaboration)

In 2018, the behaviour of using entire vacant houses as short-term rentals was cracked down, and only 1 neighbourhood in Greater Manchester remained at the Far Above level in terms of Revenue Performance. The number of neighbourhoods at the Above level only increased by 4, and the policy environment did not further open up rental gaps. The number of neighbourhoods at the Average-to-Above level increased by 10 compared to the previous year, with a slow growth rate, and these neighbourhoods were concentrated in the southern boroughs of Greater Manchester.

In 2019, the Revenue Performance indicator in the Greater Manchester area showed that the proportion of Airbnb revenue was on average about 25% higher than the proportion of Airbnb adverts, and the recovery growth of Revenue Performance led to a relaxation of rent gaps. In 2019, there were 2 neighbourhoods at the Far Above level in Greater Manchester, with an additional one in Wigan compared to 2018. The number of neighbourhoods at the Above level increased to 52. The number of neighbourhoods at the Average-to-Above level did not have a large change. Overall, although the spatial distribution of neighbourhoods with expanded rent gaps has spread to all boroughs of Greater Manchester, it has not yet formed a continuous development trend in areas outside the city centre.

5.3.3 Bristol

(1) The Figure 5-24 illustrates the spatial variation of the %Potential P2P Revenue metric from 2017 to 2019 in Bristol. It indicates that in 2017, the average level of this metric across all Bristol neighbourhoods could reach 59.03%-77.13%, suggesting that Bristol's short-term rental market may be slightly higher than London and Manchester. At this point, no neighbourhood was fully occupied by short-term home-sharing activities to achieve the Above level. Two neighbourhoods at the Average-to-Above level were located mainly in Ashley and Easton, vibrant and diverse residential areas adjacent to the city centre.

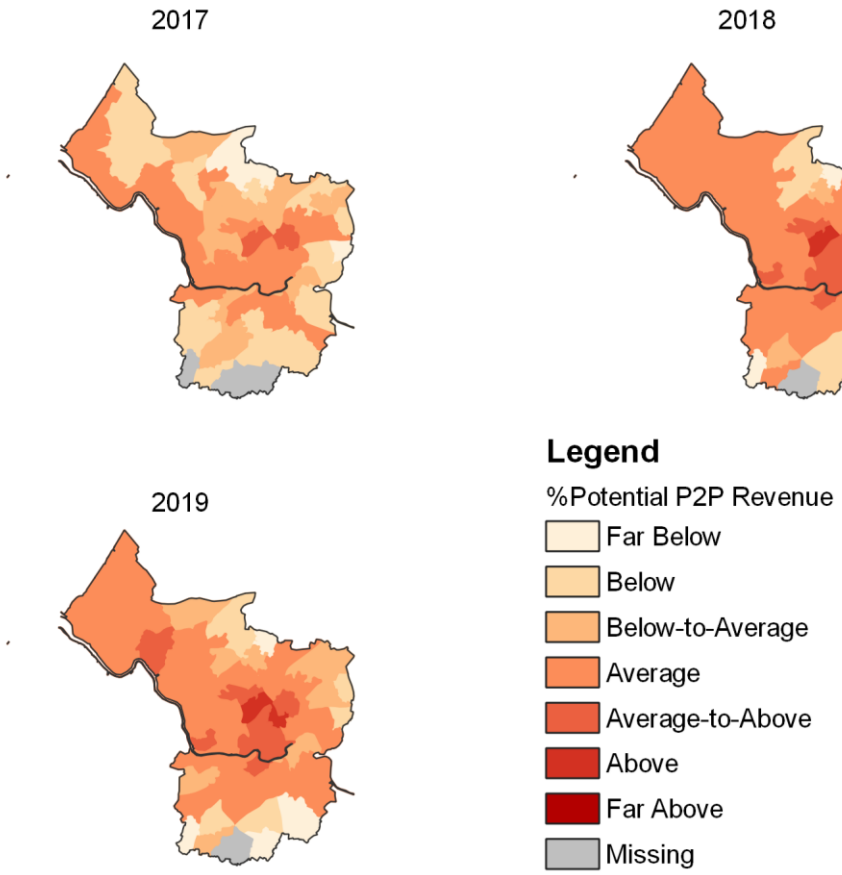


Figure 5-24 The rent gap measured by percent of potential P2P revenue in Bristol. (Own elaboration)

In 2018, the neighbourhood of Ashley exceeded the Average-to-Above threshold and achieved the Above level, indicating a further increase in the number and profitability of Airbnb rentals, with Airbnb revenue percentage exceeding 91%. The number of neighbourhoods reaching the Average-to-Above level expanded from 2 in 2017 to 7 in both northern and southern directions, including mainly Lawrence Hill located in the eastern part of Bristol, in proximity to the city centre. This area features a diverse mix of housing types and is home to several community organisations and initiatives promoting tourism and cultural exchange.

In 2019, 2 neighbourhoods achieved the Above level. The neighbourhood in Ashley maintained this level. In addition, a neighbourhood in Easton was upgraded from Average-to-Above to Above. Excluding the neighbourhood upgraded to Above, the total number of Average-to-Above neighbourhoods remained at 7. This new neighbourhood emerged owing to its scenic location on the river Avon and proximity to popular attractions like Clifton Suspension Bridge and Bristol Zoo, with a relatively high number of rental properties.

(2) Figure 5-25 displays the spatial variation of the %Professional Hosts Revenue indicator from 2017 to 2019, which differs slightly from the results of the %Potential P2P Revenue indicator. It indicates that in 2017, no area had a 'Far Above' level professional hosts' revenue. Few professional landlords are able to capture excess profits at this point. There were only 4 neighbourhoods at the 'Above' level, most of them are located in the suburbs. Additionally, there are no neighbourhoods at the Average-to-Above level.

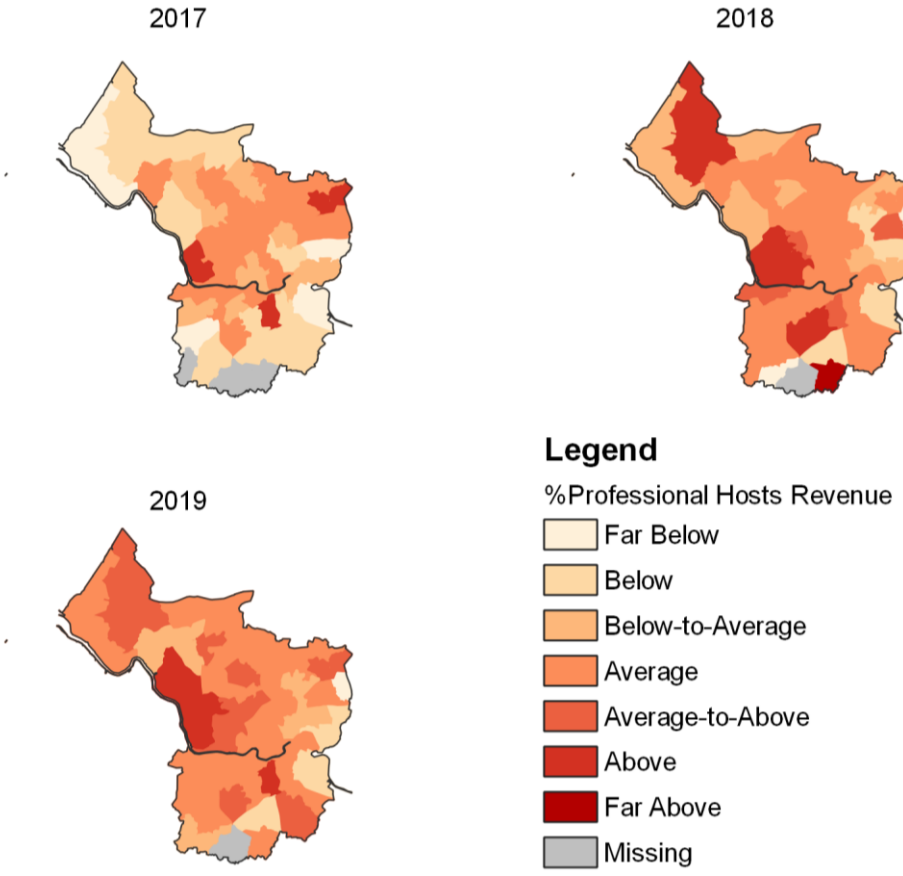


Figure 5-25 The rent gap measured by percent of professional hosts revenue in Bristol. (Own elaboration)

In 2018, the number of neighbourhoods at the Above level increased to 8, and the number of neighbourhoods at the Average-to-Above level increased by 4. The overall trend of transforming entire houses into short-term rentals for revenue

stepped up, and areas with revenue ratios higher than the Average level in Bristol expanded.

In 2019, following the momentum of the previous expansion, the number of neighbourhoods in Bristol at the Above level slightly decreased though, the number of neighbourhoods at the Average-to-Above level doubled to 9. The number of neighbourhoods at the Average-to-Above level also remained at 27. Generally, areas around the city centre and Clifton Suspension Bridge have more entire houses used for short-term rental, leading to an increased risk in gentrification.

(3) Figure 5-26 displays the spatial variation of the Revenue Performance indicator in Bristol from 2017 to 2019. It indicates that in 2017, there is no neighbourhood at the Far Above level though, 7 neighbourhoods at the Above level located either from the city centre extending to the southeast or around the port. Certain short-term rentals generated huge revenues in these areas with the rent gap opening up. There were 10 neighbourhoods at the Average-to-Above level, which are in a distance to the city centre.

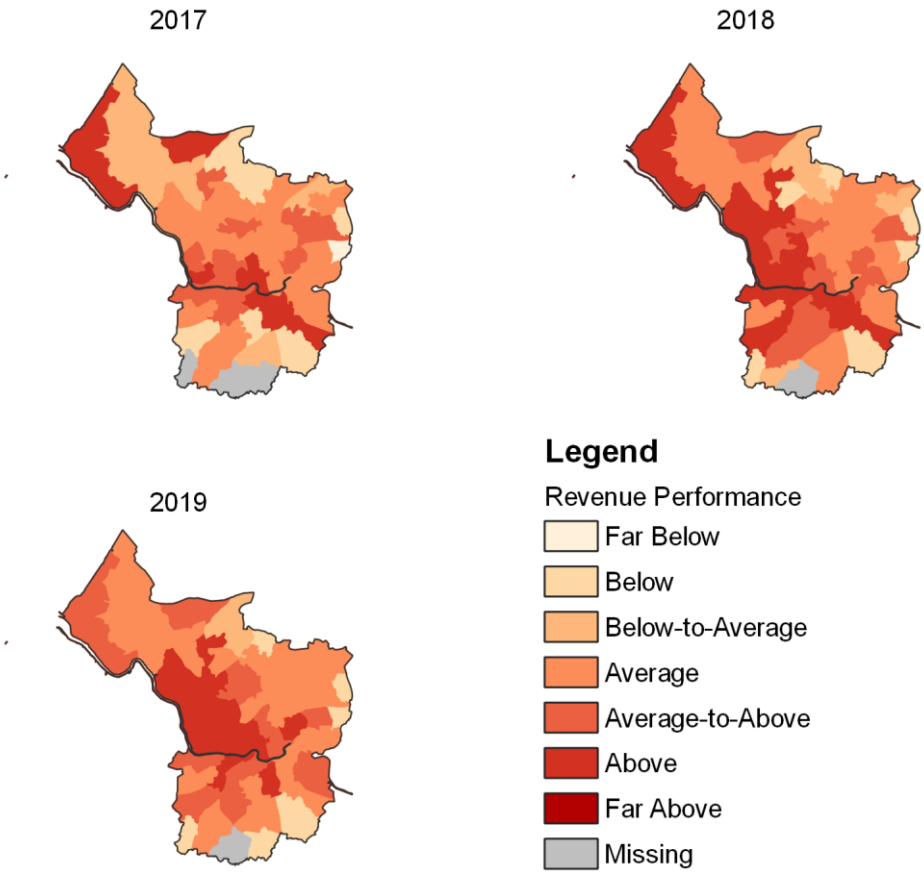


Figure 5-26 The rent gap measured by percent of revenue performance in Bristol. (Own elaboration)

In 2018, the proportion of Airbnb revenue was on average about 31% higher than the proportion of Airbnb adverts, and the rent gap has opened further. The

number of neighbourhoods at the Above level doubled to 14, where areas around Bristol's typical landmarks have been rewarded with a surge in the popularity of the short-term rental market. The number of neighbourhoods at the Average-to-Above level increased by 2 on the basis of the previous year, and these neighbourhoods were both sides of the river Avon.

In 2019, according to the Revenue Performance indicator, the Bristol area experienced a slow but concentrated trend. This means that the number of neighbourhoods with Above and Average-to-Above rent gaps remained stable from the previous year. However, these neighbourhoods were mainly located in the affluent central areas of Bristol, indicating a spatial concentration of the risk of gentrification.

5.4 Which neighbourhoods are more likely to create rent gaps?

Numerous economic and social issues within cities, such as touristic bubbles, housing scarcity, social inequality, unemployment, criminality, and poverty in spatial 'hotspots' are often highly coupled with the characteristics of the neighbourhood, hence spurring discussions regarding neighbourhood effects (Hincks, 2015; Fransham, 2020).

The social demographic characteristics of the neighbourhood have innumerable connections with touristic and short-letting activities, which would greatly affect the emergence of the rent gap. First, if a neighbourhood has a certain artist community, long history or multiculturalism, this may attract tourists because these characteristics provide unique travel experiences (Morales-Pérez, Garay, & Wilson, 2020). Second, the socio-demographic characteristics of a neighbourhood may also affect the short-term rental market. For example, if a neighbourhood is composed primarily of young professionals or students, the short-term rental market may be particularly active, as these individuals may travel frequently and need to rent out their homes (Valente et al., 2023). Similarly, if the neighbourhood has a large number of expatriate residents or immigrants, they may have family and friends who visit frequently, which may contribute to an increase in short-term rental demand in this area (Lagonigro, Martori, & Apparicio, 2020). In addition, travelling and short-term rental activity itself can affect the demographic characteristics of a community (Cocola-Gant, 2018). In the long term, this may lead to changes or transitions in neighbourhood demographics. Therefore studying rent gaps at the neighbourhood scale is necessary.

The OAC considers many socio-economic and demographic differences, these groupings represent neighbourhood clusters with certain shared characteristics but with significant differences from other groups, these characteristics include income, occupations, educational levels, family types and housing types and more. The OAC provides a simple method as it is easy to utilise and understand, it can ascertain whether the distribution of short-let properties relates to neighbourhood

characteristics, hence helping us better understand the relationship between neighbourhood characteristics and rent gaps created by short-term letting. Next, a cross-tabulation analysis of the rent gap size for each city will be conducted according to the Supergroup hierarchy of the OAC.

5.4.1 Greater London

Table 5-4 presents the neighbourhood types recorded in the OAC and the grading of rent gaps, in order to gain a deeper understanding of neighbourhood characteristics related to rent gap distribution in Greater London. For instance, the supergroup with the highest Revenue Performance level primarily consists of Inner City Cosmopolitan neighbourhoods. Within this level, there are three neighbourhoods classified as Far Above, accounting for 37.5% of all supergroups at this level. Additionally, there are 242 Above level neighbourhoods, representing 77.8% of all supergroups, and 119 Average-to-Above level neighbourhoods, making up 58.6% of all supergroups at this level. These findings illustrate that areas with high Revenue Performance are mainly concentrated in the central part of London. Inner city cosmopolitan neighbourhoods offer the most lucrative market for Airbnb hosts in London, characterised by high density, youthfulness, internationalisation, and complex and open communities. With numerous cultural and tourist destinations, Inner City Cosmopolitan neighbourhoods provide excellent market opportunities for Airbnb in the region, aligning with the spatial distribution patterns of short-term rental properties in London.

Table 5-4 Cross-tabulation of the rent gap and the output area classification in Greater London.

OAC\Revenue Performance		Far Below	Below	Below-to-Average	Average	Average-to-Above	Above	Far Above	All
Cosmopolitan student neighbourhoods	N	0	0	1	2	3	0	0	6
	% col	0	0	0.9	0.7	1.5	0	0	0.6
Ethnically diverse professionals	N	3	29	34	58	28	24	2	178
	% col	60	35.8	31.8	21.6	13.8	7.7	25	18.1
Hard-pressed communities	N	1	2	2	2	0	5	0	12
	% col	20	2.5	1.9	0.7	0	1.6	0	1.2

Inner city cosmopolitan	N	0	0	4	60	119	242	3	428
	% col	0	0	3.7	22.4	58.6	77.8	37.5	43.5
Multicultural living	N	1	48	57	138	51	37	2	334
	% col	20	59.3	53.3	51.5	25.1	11.9	25	34
Suburban living	N	0	2	9	8	2	3	1	25
	% col	0	2.5	8.4	3	1	1	12.5	2.5
All	N	5	81	107	268	203	311	8	983
	% col	100	100	100	100	100	100	100	100

The supergroup with the second-highest Revenue Performance level in London is primarily composed of Multicultural Living Neighbourhoods. Within this level, there are two Far Above level neighbourhoods, accounting for 25% of all supergroups at this level. Additionally, there are 37 Above-level neighbourhoods, representing 11.9% of all supergroups, and 51 Average-to-Above level neighbourhoods, accounting for 25.1% of all supergroups. This indicates that areas with high Revenue Performance may also be due to their cultural diversity, vibrant atmosphere, and unique attractions. This implies that there is a high demand for short-term accommodations from tourists and visitors who want to experience the local culture and way of life.

The supergroup with the third-highest Revenue Performance level in London is primarily Ethnically Diverse Professional neighbourhoods. Within this level, there are two Far Above-level neighbourhoods, accounting for 25% of all supergroups at this level. Additionally, there are 24 Above-level neighbourhoods, representing 7.7% of all supergroups, and 28 Average-to-Above level neighbourhoods, accounting for 13.8% of all supergroups at this level. This indicates that in areas characterised by ethnic diversity, high population density, relatively crowded living conditions, a relatively young age structure, and a higher proportion of social or private rentals, there is an above-average demand for short-term rentals, resulting in higher Revenue Performance for Airbnb.

Apart from the aforementioned types of areas, the insignificant characteristics of neighbourhoods with respect to Revenue Performance in London are mainly manifested as Suburban living, Hard-pressed Communities, and Cosmopolitan Student Neighbourhoods. These areas are less attractive to Airbnb due to their relatively remote locations, and their housing conditions are not in line with the needs of Airbnb users, thus making it challenging for Airbnb to penetrate the local rent gap. Additionally, Countryside Living and Industrious Communities are not included in the statistics as they are not present in Greater London.

5.4.2 Greater Manchester

Table 5-5 displays the neighbourhood types recorded in 2019 using the OAC and the graded rent gaps, aiming to gain a comprehensive understanding of the neighbourhood characteristics regarding rent gap distribution in Greater Manchester. For instance, the supergroup with the highest Revenue Performance level in Greater Manchester is primarily composed of Hard-pressed Communities. Within this level, there is 1 neighbourhood classified as Far Above, representing 50% of all supergroups at this level. Additionally, there are 14 Above-level neighbourhoods, accounting for 14.3% of all supergroups, and 12 Average-to-Above level neighbourhoods, making up 27.3% of all supergroups at this level. These findings indicate that areas with high Revenue Performance are predominantly concentrated in economically disadvantaged regions of Greater Manchester with high unemployment rates. Firstly, these communities lack affordable housing, and the high unemployment rates in these areas mean that many residents may seek temporary accommodations while searching for employment or waiting for economic conditions to improve. Secondly, the proportion of highly educated individuals in these areas is lower than the average, implying that many residents may be engaged in low-paying jobs or have difficulty finding stable employment. These factors may make it challenging for them to enter into long-term rental agreements, creating a stable demand for short-term rentals and making short-term rentals a more attractive option that can be more profitable than long-term rentals.

Table 5-5 Cross-tabulation of the rent gap and the output area classification in Greater Manchester.

OAC\Revenue Performance		Far Below	Below	Below-to-Average	Average	Average-to-Above	Above	Far Above	All
Cosmopolitan student neighbourhoods	N	0	1	1	3	5	4	0	14
	% col	0	2.1	2.9	2.7	7.6	7.1	0	4
Countryside living	N	0	0	2	0	1	0	0	3
	% col	0	0	5.7	0	1.5	0	0	0.9
Ethnically diverse professionals	N	0	3	1	15	18	8	0	45
	% col	0	6.2	2.9	13.4	27.3	14.3	0	13
Hard-pressed communities	N	1	19	7	37	12	14	1	95

	% col	50	39.6	20	33	18.2	25	50	27.5
Industrious communities	N	1	10	9	13	8	11	0	60
	% col	50	20.8	25.7	11.6	12.1	19.6	0	17.3
Inner city cosmopolitan	N	0	0	0	1	1	1	0	3
	% col	0	0	0	0.9	1.5	1.8	0	0.9
Multicultural living	N	0	5	4	17	11	9	0	48
	% col	0	10.4	11.4	15.2	16.7	16.1	0	13.9
Suburban living	N	0	10	11	26	10	9	1	78
	% col	0	20.8	31.4	23.2	15.2	16.1	50	22.5
All	N	2	48	35	112	66	56	2	346
	% col	100	100	100	100	100	100	100	100

The supergroup with the second-highest Revenue Performance level in Greater Manchester primarily consists of Ethnically Diverse Professional neighbourhoods. Within this level, there are eight Above-level neighbourhoods, accounting for 14.3% of all supergroups at this level. Additionally, there are 18 Average-to-Above level neighbourhoods, making up 27.3% of all supergroups at this level. Ethnically Diverse Professionals in the Greater Manchester region is mainly concentrated in the city centre and surrounding areas characterised by convenient public transportation, cultural diversity, and industrial diversification. These factors collectively contribute to the prevalence of short-term rentals in these areas, maintaining significant profit potential.

The supergroup with the third-highest Revenue Performance level in Greater Manchester includes Suburban Living, Multicultural Living, and Industrious Communities. For Suburban Living neighbourhoods, there is one Far Above-level neighbourhood, nine Above-level neighbourhoods, and ten Average-to-Above level neighbourhoods. For Industrious Communities, there are eleven Above-level neighbourhoods and eight Average-to-Above level neighbourhoods. For Multicultural Living neighbourhoods, there are nine Above-level neighbourhoods and eleven Average-to-Above level neighbourhoods. These neighbourhoods either fall within the suburban areas, where residents may have greater mobility and flexibility in their housing needs, or they are multicultural areas that often attract tourists seeking to experience different cultures and lifestyles. Alternatively, some areas may lack hotels or other types of short-term accommodations, making Airbnb a more affordable option than hotels in urban areas, thus appealing to budget-conscious travellers. This makes P2P short-term rentals a viable option, resulting in higher rental income and profitability.

Apart from the aforementioned types of areas, the insignificant characteristics of neighbourhoods in terms of Revenue Performance in Greater Manchester are mainly reflected in Cosmopolitan Student Neighbourhoods, Countryside Living, and Inner City Cosmopolitan areas. These areas may lack suitable housing for

conversion into short-term rentals, and many landlords may be unwilling to convert their own residences for short-term rental purposes. Furthermore, some of these areas may have a relatively limited range of amenities and facilities catering to short-term renters. Overall, the residential structures and community environments in these insignificant areas determine the difficulty for Airbnb to open the local rent gaps.

5.4.3 Bristol

Table 5-6 presents the 2019 OAC records of neighbourhood types and the grading of rent gap sizes, aiming to delve into the neighbourhood characteristics of rent gap distribution in Bristol. For instance, among the supergroups in Bristol, the predominant group with the highest Revenue Performance level is the Cosmopolitan Student Neighbourhoods, with 8 neighbourhoods classified as Above level, accounting for 61.5% of all supergroups at this level. Additionally, there are 4 neighbourhoods classified as Average-to-Above level, representing 33.3% of all supergroups at this level. This indicates that areas with higher Revenue Performance levels are primarily concentrated in Bristol's cosmopolitan student communities. Firstly, geographically speaking, these communities are located in proximity to Bristol's universities, attracting a higher concentration of short-term visitors and students, resulting in increased demand for short-term accommodations. Consequently, there are fewer regulatory constraints imposed by the government and other institutions on short-term rentals, allowing property owners in these areas to reap higher profits from short-term rentals. Secondly, in terms of residential characteristics, residents in these communities are more likely to reside in collective living establishments such as student dormitories and apartments, which are inherently suitable for short-term stays. Additionally, these communities have a higher proportion of private or social rental housing, providing favourable conditions for short-term rentals. Lastly, in terms of employment characteristics, residents in these communities are more likely to be engaged in accommodation or food service activities, which are characterised by higher rates of part-time employment and work intensity. This creates a greater need for short-term and convenient options among the residents.

Table 5-6 Cross-tabulation of the rent gap and the output area classification in Bristol.

OAC\Revenue Performance		Far Below	Below	Below-to-Average	Average	Average-to-Above	Above	Far Above	All
Cosmopolitan student neighbourhoods	N	0	0	0	2	4	8	0	14

	% col		0	0	9.5	33.3	61.5		25.5
Ethnically diverse professionals	N	0	1	1	5	4	4	0	15
	% col		16.7	50	23.8	33.3	30.8		27.3
Hard-pressed communities	N	0	1	1	5	3	0	0	11
	% col		16.7	50	23.8	25	0		20
Industrious communities	N	0	1	0	2	0	0	0	3
	% col		16.7	0	9.5	0	0		5.5
Inner city cosmopolitan	N	0	0	0	1	0	0	0	1
	% col		0	0	4.8	0	0		1.8
Multicultural living	N	0	2	0	4	1	1	0	8
	% col		33.3	0	19	8.3	7.7		14.5
Suburban living	N	0	1	0	2	0	0	0	3
	% col		16.7	0	9.5	0	0		5.5
All	N	0	6	2	21	12	13	0	55
	% col		100	100	100	100	100		100

Turning to the second highest supergroup in terms of Revenue Performance in Bristol, it is predominantly composed of Ethnically Diverse Professionals. Among these areas, 4 neighbourhoods are classified as Above level, representing 30.8% of all supergroups at this level. Additionally, there are 4 neighbourhoods classified as Average-to-Above level, accounting for 33.3% of all supergroups at this level. Ethnically diverse professionals in the Bristol area are primarily concentrated within a 5-6 km distance from the city centre. These neighbourhoods frequently attract a diverse range of ethnic professionals, who exhibit transient career patterns and have unique lifestyle preferences that favour more flexible and adaptable accommodation environments. Furthermore, the prevalence of young, highly educated professionals generates a sustained demand for flexible and temporary housing options, thereby boosting the short-term rental market and creating a favourable environment for diverse short-term leasing within Bristol's communities.

As for the third highest supergroup in terms of Revenue Performance, which primarily comprises Hard-pressed Communities, 3 neighbourhoods are classified as Average-to-Above level, accounting for 33.3% of all supergroups at this level. Hard-pressed communities in the Bristol area are primarily located on the outskirts of the city. The historical industrial background and distance from the city centre contribute to a sustained demand for flexible and temporary housing options to meet the needs of temporary workers, contractors, and individuals

seeking affordable housing solutions. However, the profit obtained from low-income long-term tenants in these areas is relatively lower.

In addition to the aforementioned types of areas, the areas in Bristol where Revenue Performance is not significant primarily exhibit characteristics such as Industrious Communities, Inner City Cosmopolitan, and Suburban Living. These areas either have a more stable population with limited demand for short-term rentals or higher rental costs, limiting the profit potential for short-term rentals. Overall, the residential structure and locational characteristics of these non-significant areas make it challenging for Airbnb to tap into the local rent gap.

In summary, the younger population structure, accommodation types suitable for short-term lets, employment characteristics with higher rates of part-time employment, and the geographical advantage of being located near universities in cosmopolitan student communities contribute to the higher profitability of short-term rentals in the area. These factors collectively create a higher demand for short-term housing and a relatively relaxed supply environment, allowing short-term rental hosts to achieve higher returns through premium rental rates. Furthermore, from a demographic perspective, these communities have a younger and more diverse population structure, and young people tend to choose short-term leases as their lifestyles are more flexible and less constrained by long-term rental obligations.

5.5 Summary and Conclusion

The spatio-temporal analysis from multi-perspectives such as spatio-temporal characteristics, rent gap changes and neighbourhood profiles provide useful insights into the development and impacts of Airbnb in major UK cities.

Airbnb listings are generally concentrated in central, touristy neighbourhoods with faster growth rates but also spreading to outer boroughs in London and Manchester with slower pace, as the convenience of public transportation continues to improve, these support the findings of previous research in Houston (Yang & Mao, 2020). The spatial distribution patterns slightly differ in terms of the city size, with a multi-core clustering in the mega city (Greater London) (Shabrina, Arcaute, & Batty, 2021), primary core and various subordinates in medium sized city (Greater Manchester) and node-and-link development in smaller city (Bristol) (Voltes-Dorta & Inchausti-Sintes, 2020; Yates et al., 2021). Entire home and private room Airbnb properties tend to have relatively consistent spatial distribution in Greater Manchester and Bristol. However, they have different locational choices in the mega city, where entire home properties form the high-density core while private rooms are more prevalent in Outer London areas. This goes hand-in-hand with the presence of a rich diversity of cultural venues that attract short-term renters and more pronounced differential ground rent in bigger cities such as Athens, Lisbon and Milan (Amore, Bernardi, & Arvanitis, 2020).

All three cities have seen the opening of significant rent gaps whereby the revenue potential from Airbnb exceeds actual rents from long-term leases in several neighbourhoods. Areas at the highest risk of gentrification are mainly touristy, central neighbourhoods (Yrigoy, 2019). The rent gaps tend to be higher when calculated based on the proportion of potential P2P rental revenues by total rental revenue and the revenue performance relative to quantity. However, the rent gaps are less pronounced in central areas when only evaluating revenue from entire home listings operated by professional hosts on Airbnb platforms, but are more prominent in some outer suburbs, suggesting varied profitable trends (Campbell et al., 2019).

There has generally been some diffusion of the rent gaps from the initial hotspots in central urban areas to the wider suburbs and boroughs in recent years (Destefanis et al., 2022). The scale and growth of the rent gaps have been the highest in London, but relatively muted in Manchester and Bristol, which is due to differences in the level of infrastructure investment and tourist attractiveness of these cities. However, periods of expansion were punctuated by slowdowns due to emerging competition and regulations in Greater London.

Across all three cities, centrally located, inner-city cosmopolitan and student areas, characterised by cultural and tourist attractions, internationalisation, and complex and open communities, have witnessed the largest Airbnb-induced rent gaps (Gutiérrez et al., 2017; Rabiei-Dastjerdi, McArdle, & Hynes, 2022). These neighbourhoods absorb huge demands for short-term rentals but leave crowding out risks for affordable housing. Greater London and Greater Manchester tend to be dominated by cosmopolitanism, whereas student-dominated areas are more prevalent in Bristol, which has rarely been mentioned in previous research. In Greater London, upscale communities are making excess profits while it may worsen the housing affordability for lower income neighbourhoods in Greater Manchester. Besides, ethnically diverse communities have the second-highest rent gap level in Greater London and Greater Manchester which attract interest from visitors keen to experience local lifestyles, also fuelling short-term rental demands (Lagonigro, Martori, & Apparicio, 2020).

The expansion of rent gaps across different neighbourhood types is largely driven by cosmopolitan tourism, especially in bigger cities. Improvements in social infrastructure and public services often deepen this gap. However, other city characteristics such as cultural and ethnic diversity may also play a role. The analysis has revealed that many entire home properties were shifted to the short-term rental market, which could affect the housing prices in the surrounding areas. Therefore, it is worth exploring the impact of frequent short-term rentals on the neighbourhood housing market.

CHAPTER 6
THE IMPACT OF PROFESSIONALISED PEER-TO-PEER ACCOMMODATION ON HOUSE PRICES

6.1 Introduction

P2P accommodation platforms have introduced a new avenue for property owners to monetise their assets. Landlords can now rent out rooms or entire homes on a short-term basis to tourists, a venture that often generates more income than traditional long-term leases, especially in sought-after tourist destinations. This shift in the property landscape has given rise to a new form of rent gap (Wachsmuth & Weisler, 2018; Wang et al., 2023), which is the difference between the actual and potential ground rent from a property.

By offering their properties on P2P platforms, landlords captured the higher value of their properties in the tourism market, while displacing long-term residents who cannot afford the inflated rents, which might exert stress on gentrification, social exclusion, and housing shortages (Lee, 2016; Attri & Bapuji, 2021; Mermet, 2022). By revisiting the rent gap theory, the analysis has indeed observed an opening rent gap through a set of indicators.

However, the emergence of P2P accommodation extends its impact beyond the confines of the rent gap. It also poses new challenges and impacts on the housing market (Farmaki & Miguel, 2022), especially in urban areas where the demand for both tourism and residential housing is high. Frequent home sharing activities have also raised concerns about their impacts on the urban housing market and the local communities. One of the main issues lies in the effect of P2P accommodation on house prices.

There is ongoing debate as to whether urban vacation rentals remove housing that would otherwise be rented on the private rental market—essentially converting it from residential to commercial use—thus aggravating a pre-existing scarcity of rental housing (Benítez-Aurioles & Tussyadiah, 2021; Liang, Yeung, & Au, 2022). To assess whether this process is significant, planners and policymakers need to understand the role played in particular by entire home rentals in P2P accommodation offerings. Entire home rentals make whole dwellings, rather than mere portions of them (such as spare bedrooms), available to visitors. Moreover, entire home rentals are likely to have notable implications on the housing market in cases where they are rented for a significant proportion of a year, in marked contrast to those only occasionally rented while their usual occupants temporarily leave (Wegmann & Jiao, 2017).

With these concerns at the forefront, the main objective of this chapter is to examine the impact of the P2P accommodation boom on house prices and housing availability. The chapter adopts a spatial perspective to analyse how the distribution and proportion of long-term P2P accommodation listings in the neighbourhood affect the availability of housing. The chapter further probes the impacts of different types and sizes of Airbnb properties on housing affordability.

6.2 Geo-spatial impacts of the Airbnb property listings on housing availability

Many commentators maintain that the proliferation of house sharing, and a shortage of housing supply is destroying communities, making it hard for low-income families and the unemployed to find suitable homes (Ellen, 2015; Gurran, 2018). The growth of short-term rentals poses quantifiable risks of exacerbating existing disequilibria in the stock of dwellings available for long-term renters relative to spatial distribution. Over 60% of the 1 million active Airbnb listings in the United States originate from hosts with two or more entire home listings, with the majority of listings for periods exceeding six months (Malapit, 2020). A report analysing the scale of the short-term lettings industry in the UK and its wider impacts on the private rental sector found that active Airbnb listings in the UK increased from 168,000 in 2017 to 223,000 in 2018 – a 33% jump – capturing a sizeable market share of the burgeoning UK short-term rental market (Barker, 2020). The report further showed that 2.7% of the 15 million UK hosts had switched from long-term to short-term lettings of residential property in the private rental sector, equivalent to 50,000 dwellings rendered unavailable for long-term tenants. Hence, many Airbnb listings resemble hotel rooms or profit-driven instruments rather than collaborative economy holiday rentals.

Airbnb's near-ubiquitous encroachment into residential areas prompts the following questions: what does the popularity of house sharing platforms signify for their areas of operation? Is Airbnb diminishing limited housing supply in towns and the negative impacts on housing costs and quality of life for local residents from turnover in neighbourhoods substantial? Is there heterogeneity in such impacts across dwellings of different typologies and bedroom configurations? Henceforth, the following section will explore such issues in depth.

6.2.1 Entire home peer-to-peer rental in neighbourhoods

Table 6-1 illustrates the number of entire home Airbnb properties (operated on the platform for more than 6 months a year) in each LSOA relative to the overall housing stock, presented as percentage in quartiles across regions. The table exhibits the data at the minimum (P0), first quartile (P25), median (P50), third quartile (P75), and maximum (P100) values. A comparative analysis of the data was conducted to discern trends and disparities between housing markets across the

localised geographies. In 2019, entire home Airbnb properties rented out for long durations constituted a modest proportion of the residential housing stock in the majority of LSOAs, being concentrated in a minority of neighbourhoods.

It is observed from the data that the penetration of long-term entire home Airbnb listings exhibits notable spatial heterogeneity, with a skewed distribution characterised by a long upper tail. This indicates that Airbnb listings for extended periods are concentrated in a selection of LSOAs rather than being evenly distributed across the localities, reflecting underlying spatial variations in the structural conditions incentivising the commodification of residential properties for short-term tourist accommodation. The contagion effects of Airbnb appear to be spatially delimited, with Airbnb proliferation exhibiting localised clustering within areas conducive to the home-sharing model.

Table 6-1 Distribution of proportions for long-term entire home Airbnb listings across three cities.

LSOA(N)	Quantiles (%)				
	P0	**P25**	**P50**	**P75**	**P100**
Greater London (4835)	0.00	0.00	0.32	1.23	15.51
Greater Manchester (1673)	0.00	0.00	0.00	0.12	8.78
Bristol (263)	0.00	0.00	0.26	0.82	4.08

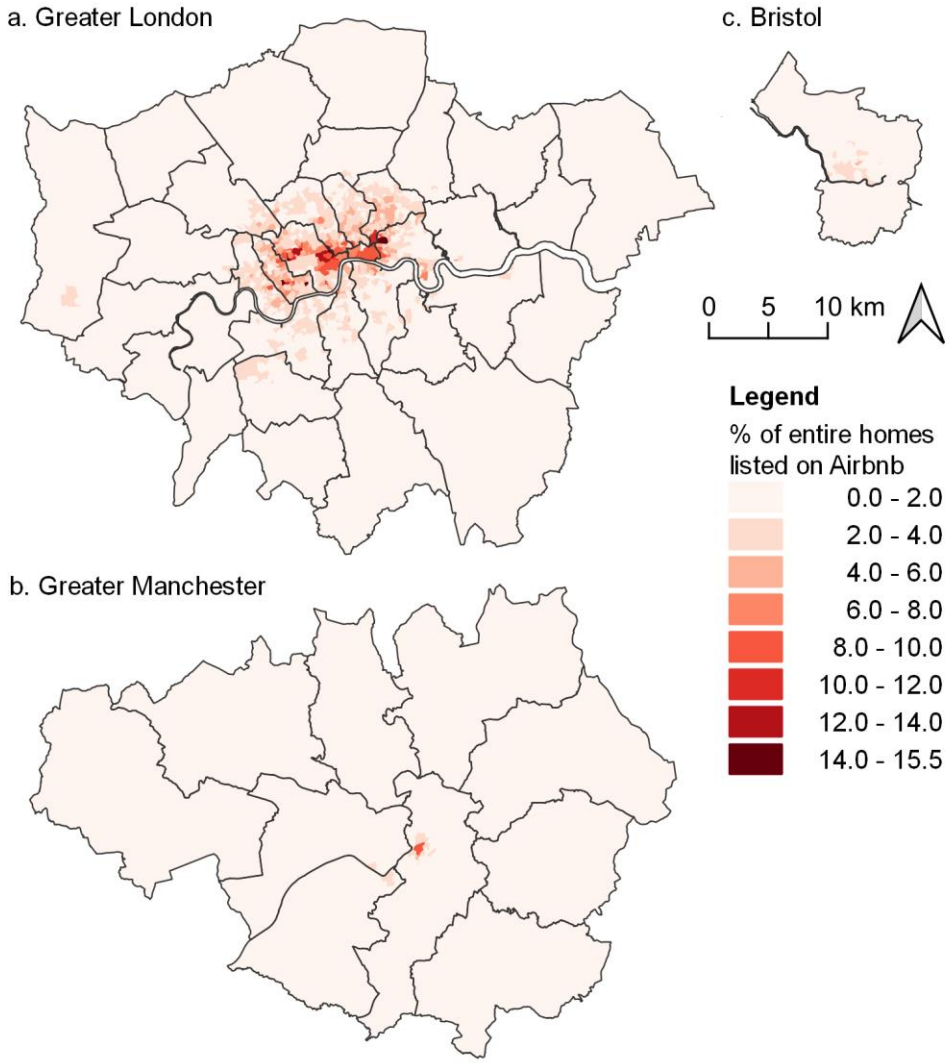


Figure 6-1 Spatial distribution of the proportion of long-term entire homes taken by Airbnb across three cities. (Own elaboration)

Based on the data presented in the Table 6-1, the P0 and P25 quantiles for LSOAs in three cities are both zero, indicating that more than a quarter of LSOAs in each city have no long-term entire Airbnb properties. This is even broader with half of the LSOAs having no such Airbnb properties in Greater Manchester. Furthermore, the interquartile range between P25 and P75 is 1.23% in Greater London, implying some heterogeneity in the percentage of entire home Airbnb properties across different LSOAs, while the narrow interquartile range of 0.12% in Greater Manchester suggests that the majority of LSOAs have very low percentages of entire home Airbnb properties. According to the P100 quantile, the maximum percentage of entire home properties on Airbnb is 15.51% in Greater London, 8.78% in Greater Manchester, 4.08% in Bristol. It means that a few LSOAs have a significantly higher concentration of entire home Airbnb properties compared to the upper quartile. This could be due to higher demand for certain areas, Airbnb could be contributing to housing shortages or affordability issues in these areas.

This demonstrates that local residents looking for long-stay units are likely to find that a portion of potential housing has been relegated to Airbnb, rather than being provided for long-stay residents. From this perspective, concerns about Airbnb's impact on the property market would not appear to be unfounded.

The Figure 6-1 shows that Central London boroughs have the highest percentage of entire homes taken up by Airbnb properties in a long-term, indicative of widespread utilisation in areas highly valued by tourists and business travellers. Kensington, Chelsea and Westminster have the most LSOAs with the indicator above 14%, indicating a highly concentrated and long-lasting Airbnb activity in these boroughs. Additionally, a neighbourhood in Tower Hamlets, East London, has second most long-term Airbnb properties in total numbers and a high percentage at nearly 15%. After counting, a total of 16 neighbourhoods around the Central Activities Zone have the indicator above 10% which is a considerable figure, showing that Airbnb use is impacting some areas more significantly than others. There are 57 LSOAs with the percent of entire home Airbnb properties ranging from 6% to 10%. These neighbourhoods extend from the centre towards the west but are still mainly confined by local authorities on the north bank of the River Thames in Central London. When considering LSOAs where the percent of long-term listed Airbnb properties surpasses the 2% threshold, their prevalence is notably concentrated within the Inner London area. This spatial distribution reveals a remarkable 86% coverage in the affluent neighbourhoods of Kensington and Chelsea, while it is lower in Haringey, Newham, and Lewisham, which reflects the socio-economic characteristics of the neighbourhoods and their attractiveness for tourists. The indicator in the rest LSOAs tends to lower as distance from the city centre increases. This may indicate that these areas are less popular among tourists or less profitable for short-term rentals. It is also possible that these remote areas have a higher proportion of owner-occupied homes or long-term rentals, which are less likely to be listed on Airbnb (Krause & Aschwanden, 2020).

In Greater Manchester, the landscape of Airbnb listings presents a different picture. The top 2 LSOA areas in Greater Manchester have a relatively high percentage of entire home Airbnb listings, at 8.78% and 8.15%, representing 72 and 53 properties, respectively. There is also one LSOA (5.59%) in terms of the indicator bordered by the south side of the former 2 neighbourhoods. This suggests that a sizable portion of housing stock in Piccadilly has been converted to short-term rentals, which could negatively impact housing availability. The percentage of entire home Airbnb listings ranges from 2% to 4% of the total housing stock across LSOA is also largely concentrated in the Manchester city centre and Old Trafford. The remaining vast majority of LSOAs have only a lower than 2% stock of housing being used for Airbnb on a long-term basis. Compared to Greater London, the percentages in Manchester are lower but still substantial in the core.

Bristol's long-term operated entire home on Airbnb demonstrates a huge contrast. The top 1 LSOA in terms of the percent of entire home Airbnb properties in Bristol only have 4.08%. This is a substantially lower percentage than the LSOAs in other cities, indicating that Airbnb properties do not hold a large share of long-term housing inventory. Compared to other cities where more properties are misused, Airbnb hosts in Bristol may have different motivations and strategies for renting out their properties. In and around Bristol city centre, 16 LSOAs show Airbnb activity indicators ranging between 2% and 4%. These areas, all located on the north bank of the Avon River, indicate a moderate but noteworthy presence. The lower overall proportion of Airbnb listings in Bristol, compared to cities with more pronounced Airbnb activity, hints at a different market dynamic.

6.2.2 Different types of peer-to-peer rentals in neighbourhoods

The varied requirements of Airbnb guests for accommodation types contribute to diverse occupancy rates in the lodging panorama (Lutz & Newlands, 2018). Vacationers and business sojourners generally favour smaller accommodations like lofts and one-bedroom flats due to their short-term needs and preference for budget-friendly and conveniently located lodgings near key attractions. Alternatively, temporary dwellers relocating for professional or academic reasons usually require larger multiple bedroom residences that can house groups and offer a more expansive living space for prolonged stays. Hence, the grouping of certain property types on Airbnb in particular regions can be partially credited to the concentrated demand from unique guest categories.

The unequal needs for accommodation also generate varying rental discrepancies affecting short-term rental submarkets in diverse ways (Cheung & Yiu, 2022). Lofts and one-bedroom homes are most susceptible to transformation into Airbnb listings owing to the immense popularity and profitability. Larger homes encounter less disturbance as they appeal to a lesser fraction of guests but can still reap from the elevated short-term rents. By mapping the distribution of listings, it is possible to spot patterns that will give us an idea of how different types of Airbnb are reshaping the layout of short-term rental housing in major metropolitan areas to meet the needs of different guests. The subsequent sections will assess this in three major cities.

6.2.2.1 Greater London

The data (Figure 6-2) reveals that the spatial distribution of the proportion of entire flats taken by Airbnb is largely similar to that of all entire homes taken by Airbnb, with higher concentration in Inner London, but there are some outliers in the outer boroughs of Greater London. However, the percentage of entire houses being converted to Airbnb properties presents a more confined spatial distribution but it is high in some central neighbourhoods.

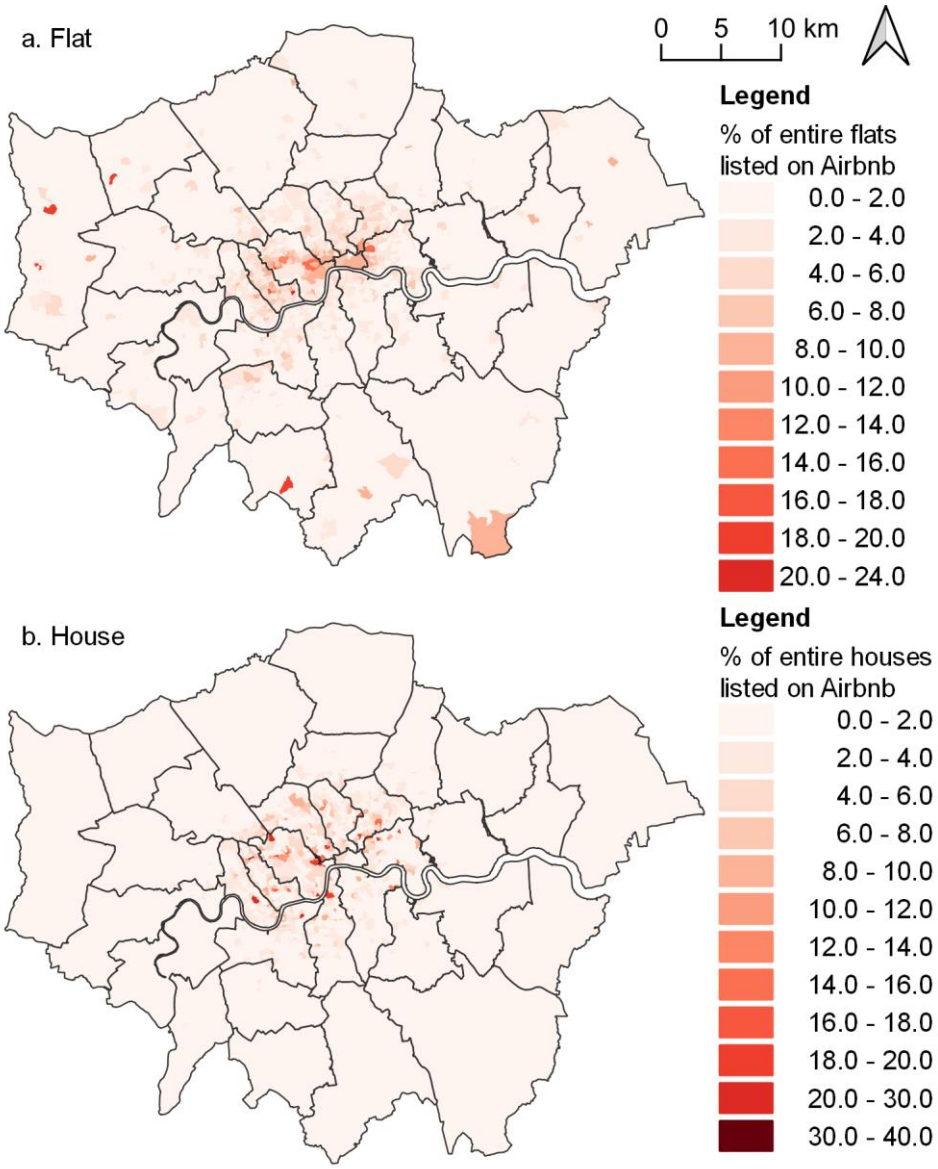


Figure 6-2 Spatial distribution of the proportion of long-term entire flats and houses taken by Airbnb in Greater London. (Own elaboration)

On top of 7 LSOAs with the percentage of entire flats above 14% in Inner London, there are also 4 neighbourhoods in outer boroughs such as Sutton, Harrow and Hillingdon. This suggests widespread Airbnb flats in various parts of London and a high demand for short-term flat rentals in these areas, but it also means a possible displacement of flat stock for local residents. Since these areas have a very low supply of flat type properties, they may be more vulnerable to the negative impacts of Airbnb on the flat sub-market.

Two LSOAs show above 30% of houses being taken by Airbnb which are located in the boroughs of Kensington and Westminster, specifically in the prosperous areas of Cambridge Gardens and Soho. These areas are known for their high concentration of cultural and entertainment venues. However, this has led to a

limited availability of houses for long-term rent. Six more LSOAs with 20%-30% of houses taken by Airbnb are spread around Central London or its neighbouring boroughs.

6.2.2.2 Greater Manchester

The proportions of long-term entire flats and houses listed on Airbnb are relatively lower in Greater Manchester (see Figure 6-3). Most of the high percentage of flat Airbnb clusters are located in Manchester city centre as expected, while only a few outliers appear in the outlying districts of Greater Manchester. The spatial distribution of the proportion of entire houses listed on Airbnb reveals that they have negligible effects on the housing stock in Greater Manchester.

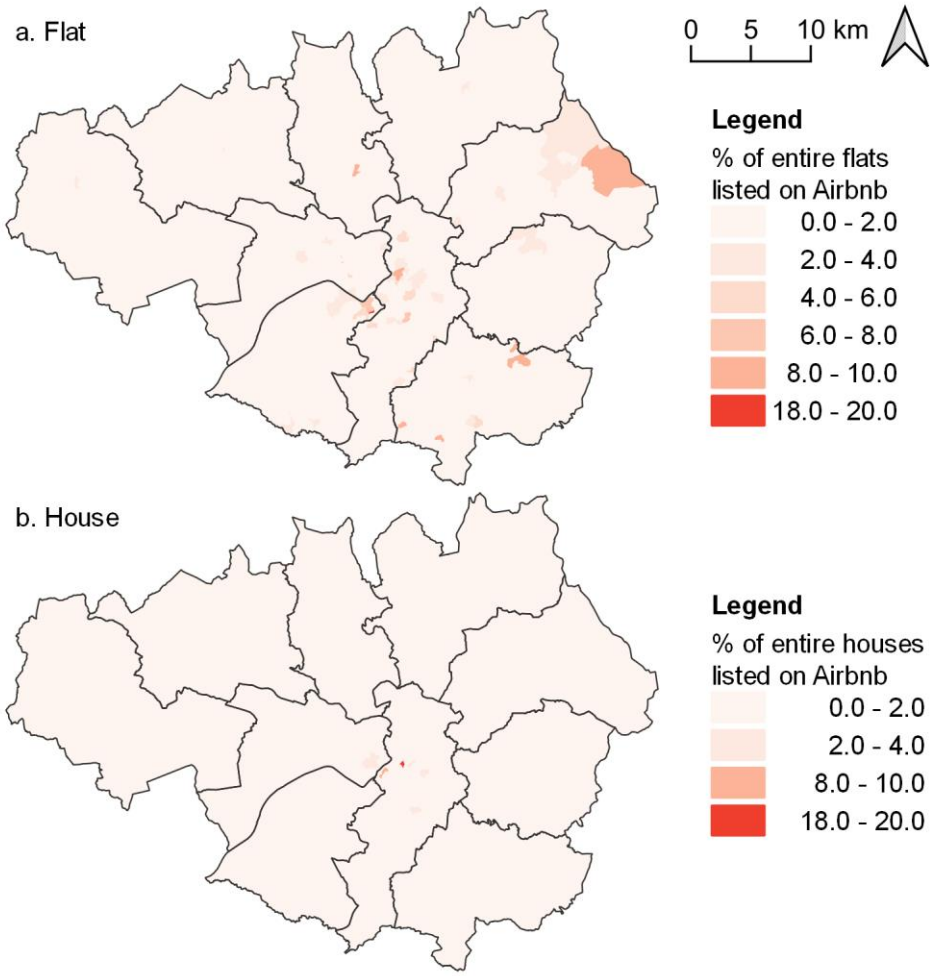


Figure 6-3 Spatial distribution of the proportion of long-term entire flats and houses taken by Airbnb in Greater Manchester. (Own elaboration)

A LSOA has 20% of entire flats listed on Airbnb, which is far higher than surrounding neighbourhoods. This may be explained by the fact that this neighbourhood is situated in Old Trafford, near athletic centres, and that the supply of flats is limited in this area. Similarly, there are 10 LSOAs with the

percentage of flat properties taken by Airbnb ranging from 6% to 10%. Two of these neighbourhoods are in Manchester city centre, but the rest are in outer areas like Stockport, Oldham and Bury. These areas may face some housing market pressures that encourage landlords to switch to short-term rentals.

For house type properties, only a few LSOAs have more than 2% of their houses listed on Airbnb. The highest proportion is 20%, found in a LSOA in the Northern Quarter of Manchester's city centre, which is known for its vibrant culture. Another LSOA with 10% of its houses on Airbnb is in Deansgate, a central area with many attractions and amenities. However, the vast majority of LSOAs have less than 2% of their houses on Airbnb. These findings suggest that entire house Airbnb properties have a limited impact on the housing market in Greater Manchester, unlike in Greater London, where they may compete with the local demand for houses.

6.2.2.3 Bristol

The percentage of flats taken by Airbnb in Bristol also extends somewhat into outer areas, while the impact on the stock of houses is concentrated in a few areas, especially near the city centre (Figure 6-4).

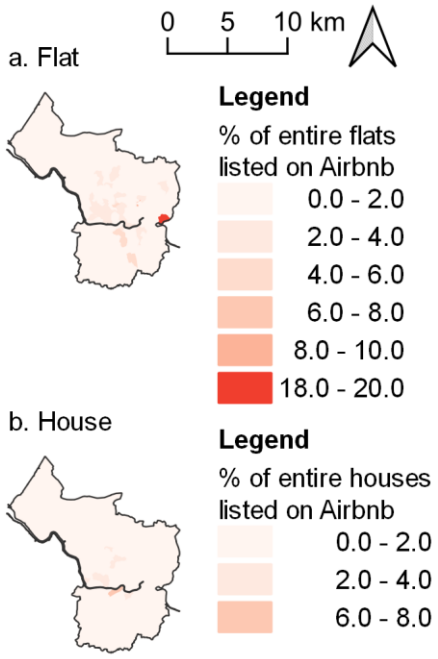


Figure 6-4 Spatial distribution of the proportion of long-term entire flats and houses taken by Airbnb in Bristol. (Own elaboration)

The most affected neighbourhood in terms of flat stock is a remote LSOA at the edge of the city, where 20% of the flats are used for Airbnb. This LSOA has limited flat supply but offers large green spaces for guests. Only one LSOA in Easton has between 6% and 10% of its flats taken by Airbnb, which is lower than in Greater

Manchester. Solely compared to Manchester borough, Bristol has a slightly higher average percentage of flats used for Airbnb and a higher number of neighbourhoods affected.

For house type properties, one neighbourhood on the south side of the river has 8% of its houses listed on Airbnb, the highest proportion in the city. Compared to Manchester, Bristol has a slightly higher average percentage of houses used for Airbnb and a higher number of affected neighbourhoods, but both cities are far behind London in terms of Airbnb penetration.

6.2.3 Peer-to-peer rentals with different bedroom numbers in neighbourhoods

The heterogeneous demands of Airbnb guests for housing sizes creates a form of spatial differentiation in the housing landscape (Chica-Olmo, González-Morales, & Zafra-Gómez, 2020). Tourists and business travellers typically prefer more compact housing units such as studios and one-bedroom apartments due to their short-term needs and desire for affordable and convenient accommodations close to points of interest. In contrast, temporary residents relocating for work or study tend to demand larger multi-bedroom houses that can accommodate groups and provide a more spacious liveable area for longer stays. Therefore, the clustering of certain property sizes on Airbnb in specific locales can be partly attributed to the concentration of demand from distinct guest segments.

The uneven demands on housing sizes also create differential rent gaps that impact housing submarkets in varied ways (Cheung & Yiu, 2022). Studio apartments and one-bedroom houses are most at risk of conversion to Airbnb listings due to the immense popularity and profitability of renting to tourists and business travellers. The concentration of such compact housing units in a neighbourhood may negatively impact the supply of affordable long-term housing options for residents. Larger houses face less disruption as they appeal to a smaller proportion of guests but can still benefit from increased short-term rents. By mapping the distribution of properties based on bedroom counts, patterns can be identified that shed light on how Airbnb is reconfiguring urban housing geographies to align with the demands of its diverse guest base. The following sections will examine it in the three cities.

6.2.3.1 Greater London

While Central London neighbourhoods dominate the one-bedroom Airbnb market, it also extends further into the suburbs (see Figure 6-5). The spatial distribution of two- and three-bedroom indicators is broadly consistent with this pattern, but their proportions are sequentially lower. However, the situation is not the case for the above four-bedroom indicator, where the high values are spread across locations in Greater London.

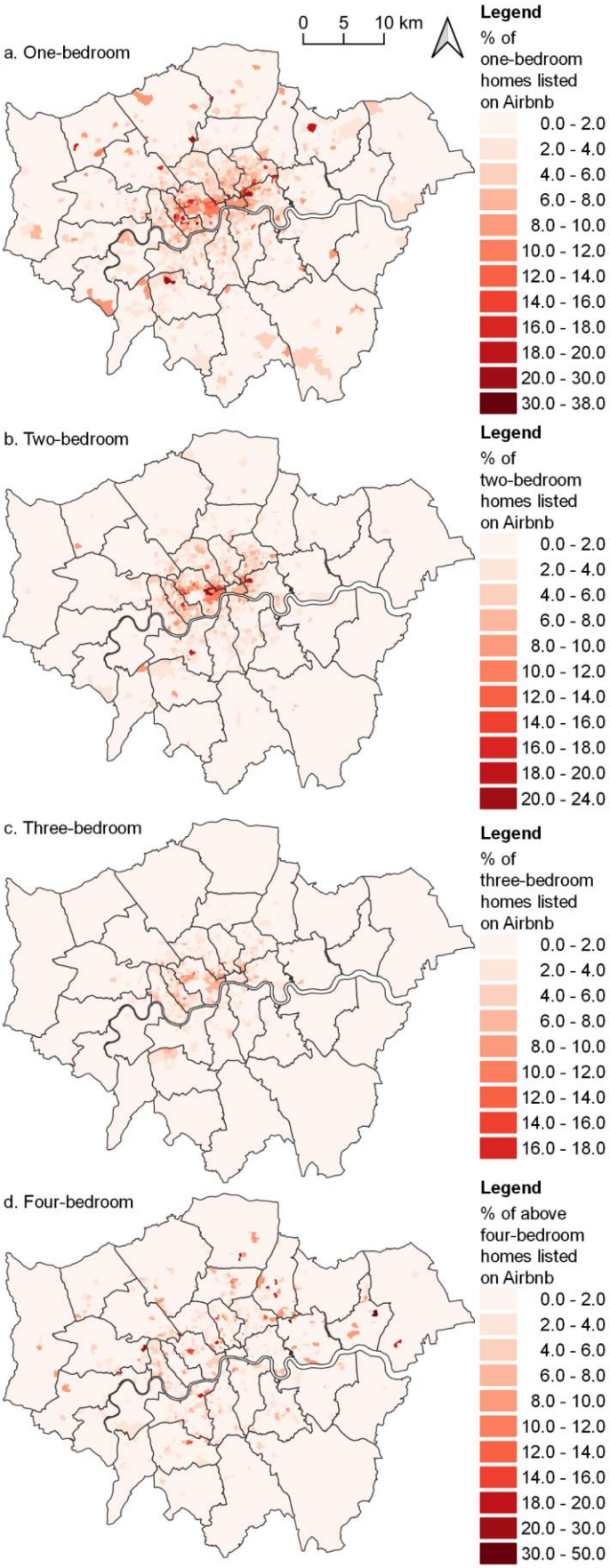

0 5 10 km
a. One-bedroom
Legend
% of one-bedroom homes listed on Airbnb
0.0 - 2.0
2.0 - 4.0
4.0 - 6.0
6.0 - 8.0
8.0 - 10.0
10.0 - 12.0
12.0 - 14.0
14.0 - 16.0
16.0 - 18.0
18.0 - 20.0
20.0 - 30.0
30.0 - 38.0
b. Two-bedroom
Legend
% of two-bedroom homes listed on Airbnb
0.0 - 2.0
2.0 - 4.0
4.0 - 6.0
6.0 - 8.0
8.0 - 10.0
10.0 - 12.0
12.0 - 14.0
14.0 - 16.0
16.0 - 18.0
18.0 - 20.0
20.0 - 24.0
c. Three-bedroom
Legend
% of three-bedroom homes listed on Airbnb
0.0 - 2.0
2.0 - 4.0
4.0 - 6.0
6.0 - 8.0
8.0 - 10.0
10.0 - 12.0
12.0 - 14.0
14.0 - 16.0
16.0 - 18.0
d. Four-bedroom
Legend
% of above four-bedroom homes listed on Airbnb
0.0 - 2.0
2.0 - 4.0
4.0 - 6.0
6.0 - 8.0
8.0 - 10.0
10.0 - 12.0
12.0 - 14.0
14.0 - 16.0
18.0 - 20.0
20.0 - 30.0
30.0 - 50.0

Figure 6-5 Spatial distribution of the proportion of properties with different bedroom numbers taken by Airbnb in Greater London. (Own elaboration)

The higher percentage of one-bedroom entire homes taken up by Airbnb properties in Central London boroughs suggests that there is a high demand for convenience and privacy, since they are self-contained units where guests can have more flexibility and control over their accommodation. One-bedroom properties or studios for short-term lettings provide an opportunity for visitors to experience living in a prime Central London location. This is appealing to many business and leisure visitors to London. Most neighbourhoods with above 6% of the indicator are in locations close to the Thames River in boroughs such as Chelsea, Westminster, Camden and the City of London. However, this indicator also exhibits a suburbanised distribution, some outlying neighbourhoods in northern and southern boroughs registering high percentages.

Central London boroughs have a relatively higher percentage of two-bedroom entire homes being occupied by Airbnb properties. A possible explanation for this phenomenon is that the Central London boroughs offer a high level of accessibility and amenities that appeal to long-term travellers who prefer more spacious and comfortable lodging options than hotels or hostels. In particular, the area around Hyde Park exhibits a remarkably low share of two-bedroom entire homes occupied by Airbnb guests, compared to other central locations. On the other hand, in the suburban areas, the proportion of two-bedroom entire homes taken by Airbnb is also relatively low. Here, the supply of this type of accommodation is likely to be constrained by the lower density of housing, the higher prevalence of owner-occupation, and the lower attractiveness for tourists.

While the impacts may be moderated for three-bedroom units relative to smaller units based on a higher degree of substitutability at the higher end of the market, meaningful frictions are still likely to accrue for long-term renters in the form of reduced choice sets and increased costs, particularly in areas demonstrating a high density of three-bedroom units taken by Airbnb. The heterogeneity in the geographic distribution of three-bedroom Airbnb properties across Greater London suggests the effects are likely to be highly localised. Given the percent of three-bedroom entire homes taken by Airbnb is generally lower than the two-bedroom indicator. A possible explanation for this phenomenon is that some three-bedroom homes may still be used primarily for long-term living by owners, leaving fewer available to be used as Airbnb properties (Zhang et al., 2020).

The impact may be somewhat moderated for dwellings above four bedrooms compared to smaller units, since they likely represent a smaller and more niche segment of the housing market. However, this does not imply that larger dwellings are immune to the influence of Airbnb, as they may still cater to a niche demand for group travel, family reunions, or special events. This implies that some

suburban neighbourhoods have a comparative advantage in attracting and accommodating a significant segment of Airbnb users who have a high demand for spacious and comfortable lodgings.

6.2.3.2 Greater Manchester

The spatial distribution of one-bedroom properties listed on Airbnb across Greater Manchester reveals a widespread pattern from Greater London (see Figure 6-6). Yet, the indicators for other larger entire homes are confined or negligible.

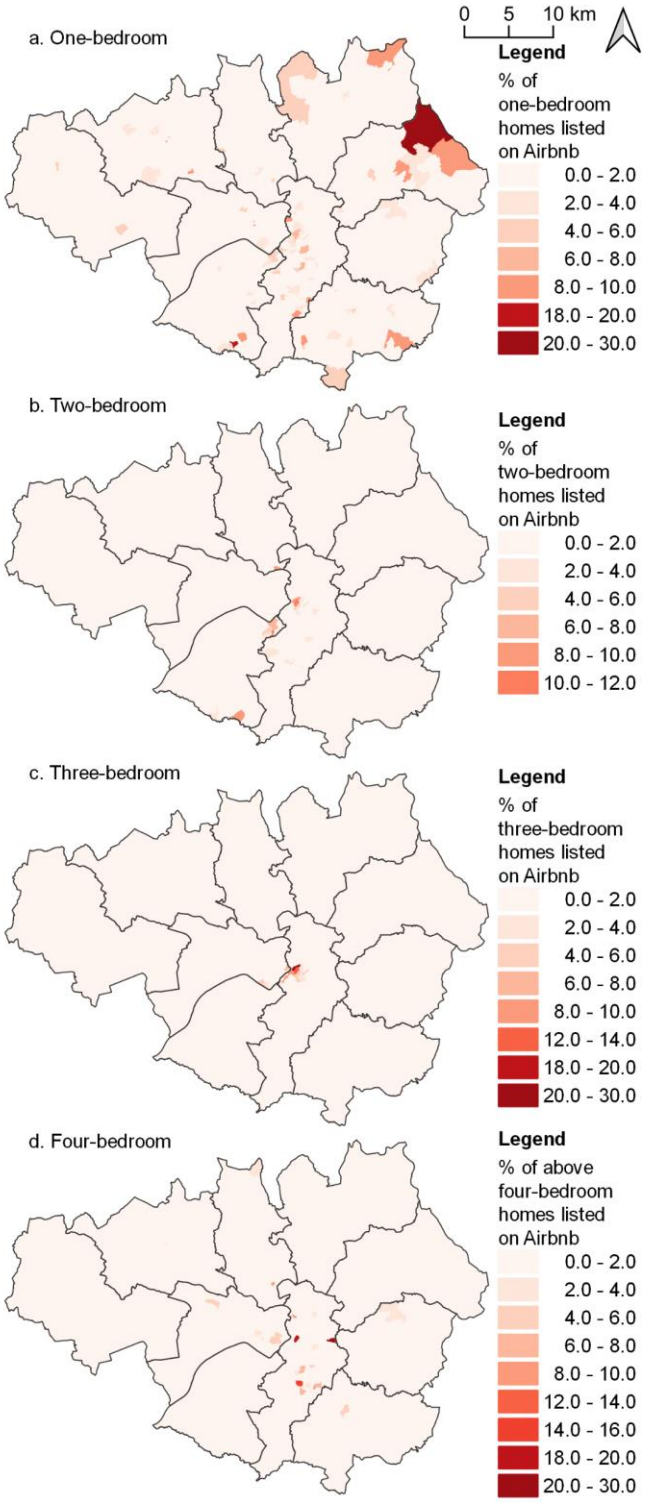


Figure 6-6 Spatial distribution of the proportion of properties with different bedroom numbers taken by Airbnb in Greater Manchester. (Own elaboration)

While Manchester borough has the higher number of neighbourhoods with more than 2% of one-bedroom properties listed on Airbnb, other boroughs such as Oldham and Trafford have some neighbourhoods with even higher percentages. These neighbourhoods are located near attractive retail or leisure destinations that offer scenic views. On the other hand, a cluster of neighbourhoods in

Manchester city centre has a low percentage of 2%-4% of one-bedroom properties on Airbnb. This suggests that the demand for one-bedroom properties on Airbnb is not concentrated in the urban core, but rather dispersed in the outer areas of Greater Manchester.

There is a relatively higher percentage of two-bedroom entire homes being occupied by Airbnb properties in Northern Quarter Manchester and Old Trafford, while the rest of the areas have a low penetration of this type of accommodation. These two areas are popular tourist destinations, offering cultural, historical and sporting attractions, as well as convenient access to public transport and amenities. Therefore, they attract more demand for short-term rentals, especially from small groups or families who prefer a bit more spacious and private lodgings. In contrast, the other boroughs may have less appeal for visitors, or may face more competition from other types of accommodation, such as hotels or hostels.

The core Manchester city has the highest percentage of three-bedroom entire homes occupied by Airbnb properties, especially in 4 LSOAs in the city centre where it exceeds 8%. This may reflect the limited availability of three-bedroom stock in the densely populated urban area. Other neighbourhoods with relatively high percentages, such as Manchester Piccadilly and Salford Quays, may experience some housing market pressure. In contrast, the penetration is negligible in most other boroughs, implying that the demand and supply of these properties are low or balanced. This may be attributed to the preference of Airbnb users for smaller or more central properties, or the preference of homeowners for longer-term rentals or personal use of their properties.

Only two LSOAs, located in central and suburban areas such as Clayton, have a percentage of above four-bedroom properties occupied by Airbnb higher than 18%. This could indicate a mismatch between the high demand and low supply of large properties in these areas, or the presence of some historical attractions that appeal to larger groups of guests. The rest of the neighbourhoods with a percentage between 2% and 15% are mainly concentrated in Manchester and Salford, with some outliers in outer boroughs. Some clusters of higher percentage are observed around Old Moat and Withington, which are southern suburbs of Manchester. These neighbourhoods attract students, families, and young professionals, and offer various shopping, tourism, and transportation options.

6.2.3.3 Bristol

The percentage of one-bedroom properties listed on Airbnb in Bristol reveals a broader spatial distribution but two- and three-bedroom properties listed on Airbnb in Bristol show relatively lower proportion clusters in and around the city centre (see Figure 6-7). In contrast, Airbnb's penetration in above four-bedroom units is more suburbanized.

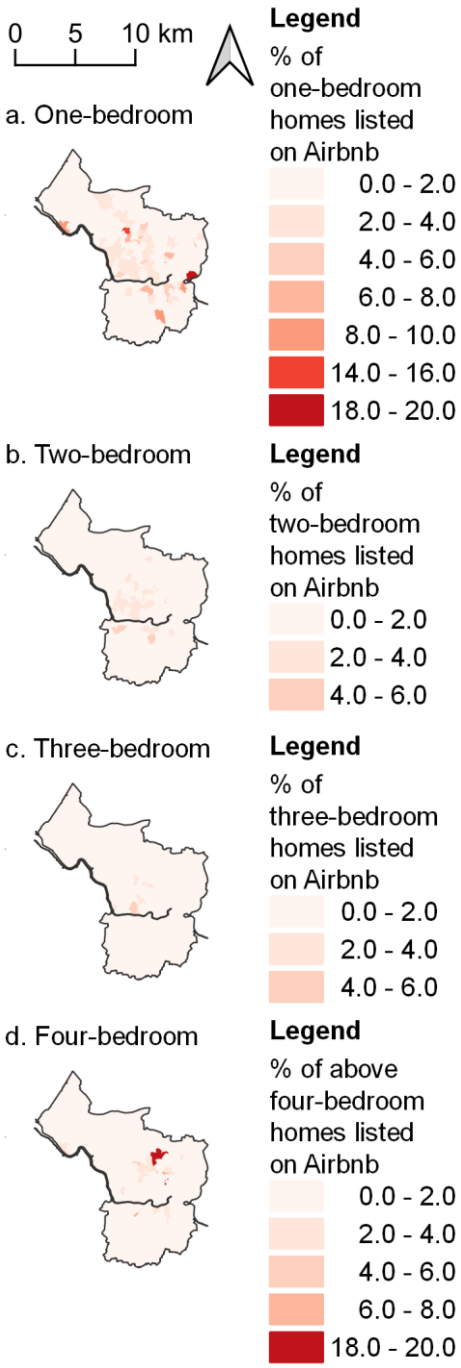


Figure 6-7 Spatial distribution of the proportion of properties with different bedroom numbers taken by Airbnb in Bristol. (Own elaboration)

The percentage of one-bedroom units that are offered as short-term rentals shows a high concentration in two suburban neighbourhoods, exceeding 14%. The majority of the neighbourhoods, 56 in total, have an indicator value between 2% and 10%. These neighbourhoods are mostly situated in the inner-city areas of Bristol, where the indicator tends to be lower, while a few outliers with higher values are scattered in the outer city areas. This suggests that the presence of one-bedroom properties on Airbnb may pose a greater challenge for housing

availability and affordability in some peripheral areas of Bristol than in the central areas.

There are some neighbourhoods near the suburbs that have a relatively higher proportion of two-bedroom properties taken by Airbnb, ranging from 4% to 6%, due to the limited two-bedroom stock. The analysis also shows a high central concentration of neighbourhoods, 24 LSOAs in total, that have a percentage of two-bedroom properties between 2% and 4%. These neighbourhoods may face some housing market pressures due to the presence of Airbnb, especially for new families or couples who need more space. The rest of the neighbourhoods, nearly 90% of the LSOAs, have a low proportion of two-bedroom Airbnb properties, below 2%. This suggests that the presence of two-bedroom properties on Airbnb does not significantly affect the housing availability in most parts of Bristol.

Only 7 LSOAs in Bristol city centre have between 2% and 6% of their three-bedroom properties occupied by Airbnb. The remaining neighbourhoods, nearly 97% of LSOAs, have a lower proportion of long-term occupied three-bedroom properties. This suggests that the majority of Bristol is not losing significant amounts of its three-bedroom housing stock to the short-term rental market.

Airbnb's penetration in above four-bedroom units is less common in the city centre. However, some higher clusters appear in Ashley and Lockleaze, to the north of the city centre, because historical and cultural attractions around these areas appeal to large-group visitors. There are also some neighbourhoods in the south side of the River Avon that have the proportion of above four-bedroom properties, ranging from 2% to 8%. The rest of the neighbourhoods, nearly 92% of the LSOAs, have a minor proportion of above four-bedroom Airbnb properties. Airbnb's market penetration of larger properties shows a marked tendency towards suburban neighbourhoods in Bristol.

6.3 Determining the implied impact of Airbnb occupied properties on neighbourhood housing prices

This section considers the relationship between Airbnb occupancy and fluctuations in the housing market, with a particular focus on the correlation between housing transaction prices and the proportion of long-term entire home Airbnb properties in the neighbourhood. Specifically, it explored whether property owners, in response to Airbnb's existence, heighten prices for selling their properties, or if potential buyers, cognizant of Airbnb's prevalence, exhibit a reduced inclination to purchase real estate in certain regions. This inquiry holds exceptional significance in the context of the United Kingdom, where the housing market has perennially grappled with supply shortages (Hincks, Webb, & Wong, 2014; Sgueglia & Webb, 2021), culminating in a relentless surge in housing prices, particularly in major urban centres.

6.3.1 Estimating a repeat sales baseline model

To estimate the repeat sales indices for the three cities, the ordinary least squares (OLS) method was firstly used, which does not adjust for heteroscedasticity (Leishman & Watkins, 2017). As explained earlier, the dependent variable is the natural logarithm of the second transaction price relative to the first transaction price. The explanatory variables are all time dummy variables. They are coded as 1 for the second transaction date and -1 for the initial transaction date.

By regressing the time dummy variables on the OLS, their coefficients were obtained. When arranged in chronological order, these variables represent the natural logarithm of the cumulative price index pertinent to their respective markets. The outcomes of this regression analysis are presented in Table 6-2.

Table 6-2 Repeat sales model baseline.

	All		**Greater London**		**Greater Manchester**		**City of Bristol**	
Predictors	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
(Intercept)	0.086 ***	0.000	0.073 ***	0.000	0.090 ***	0.001	0.066 ***	0.002
y1996	0.024 ***	0.001	0.043 ***	0.001	-0.007 *	0.003	0.228 ***	0.020
y1997	0.137 ***	0.001	0.186 ***	0.001	0.011 ***	0.003	0.346 ***	0.020
y1998	0.251 ***	0.001	0.319 ***	0.001	0.057 ***	0.003	0.450 ***	0.020
y1999	0.367 ***	0.001	0.456 ***	0.001	0.087 ***	0.003	0.598 ***	0.020
y2000	0.535 ***	0.001	0.651 ***	0.001	0.170 ***	0.003	0.781 ***	0.020
y2001	0.635 ***	0.001	0.758 ***	0.001	0.256 ***	0.003	0.894 ***	0.020
y2002	0.779 ***	0.001	0.905 ***	0.001	0.405 ***	0.003	1.103 ***	0.020
y2003	0.911 ***	0.001	1.014 ***	0.001	0.614 ***	0.003	1.261 ***	0.020
y2004	1.011 ***	0.001	1.075 ***	0.001	0.827 ***	0.003	1.357 ***	0.020
y2005	1.050 ***	0.001	1.091 ***	0.001	0.946 ***	0.003	1.395 ***	0.020

y2006	1.105***	0.001	1.151***	0.001	0.993***	0.003	1.460***	0.020
y2007	1.215***	0.001	1.283***	0.001	1.047***	0.003	1.570***	0.020
y2008	1.211***	0.002	1.288***	0.002	1.023***	0.004	1.513***	0.020
y2009	1.103***	0.002	1.186***	0.002	0.892***	0.004	1.417***	0.020
y2010	1.164***	0.002	1.263***	0.002	0.910***	0.004	1.485***	0.020
y2011	1.167***	0.002	1.277***	0.002	0.882***	0.004	1.458***	0.020
y2012	1.197***	0.002	1.321***	0.002	0.872***	0.004	1.475***	0.020
y2013	1.249***	0.002	1.390***	0.002	0.871***	0.004	1.511***	0.020
y2014	1.363***	0.002	1.533***	0.002	0.915***	0.004	1.608***	0.020
y2015	1.429***	0.002	1.618***	0.002	0.950***	0.004	1.694***	0.020
y2016	1.497***	0.002	1.710***	0.002	1.000***	0.004	1.824***	0.021
y2017	1.520***	0.002	1.730***	0.002	1.047***	0.004	1.884***	0.021
y2018	1.524***	0.002	1.712***	0.002	1.095***	0.004	1.905***	0.021
y2019	1.527***	0.002	1.696***	0.002	1.130***	0.004	1.913***	0.021
Observations	1643470		1189202		379054		75214	
R^2 / R^2 adjusted	0.540 / 0.540		0.630 / 0.630		0.512 / 0.512		0.658 / 0.658	
AIC	2320218.849		1415060.678		553977.028		75028.403	
log-Likelihood	-324183.345		-73860.651		-110890.422		-1303.902	

** p<0.05 ** p<0.01 *** p<0.001*

The table reports the R^2, adjusted R^2, and F-statistics from the repeat sales model estimated using OLS. However, the purpose of employing OLS regression is

primarily to estimate the parameters of time dummy variables. Given that the market under investigation is quite extensive and notably heterogenous, individual property's price growth rates could potentially be more volatile. Accordingly, one might anticipate that R^2, adjusted R^2 and F-statistics could be estimated lower due to market heterogeneity. As a matter of fact, subsample models for different cities crudely reflect the heterogeneity of the markets in which the price indices are estimated.

The intention is not to employ the result of this model for inference but establish a baseline for subsequent models in order to verify the validity and robustness of the modelling; and so, the model's goodness-of-fit or significance are there for reference only. The focus rests solely on the estimated coefficients of time dummy variables and their tendency. From the time-variable coefficients in the table, it is straightforward to grasp and describe local house price developments and trends. Coefficient estimates reveal the annual index values of residential real estate price indices from 1996 to 2019 for the three regions and their aggregate.

Observations from the table are as follows: First, the housing price indices of the three regions show reasonably parallel trajectories. Although each demonstrates a rise, the pace and amplitude of the growth varies. Greater London and Greater Manchester's indices reveal a more moderate increase, whereas Bristol's index exhibits greater volatility. Second, from the coefficients of the time dummy variables, one can identify common inflection or turning points within different years for the three cities and the total sample. The most evident turning point is around 2008, which corresponds with the global financial crisis — a period where the housing price index experienced a substantive decline. Another notable turning point is around 2013, around the time of the UK's economic recovery (Land Registry, 2021), during which there was a significant uplift in the housing price index. These points reflect the macroeconomic environment's impact on the property market.

Overall, the aggregate housing price index displays a relatively stable growth trend. It is also observed that the housing price indices of the three cities and the total sample are all influenced by macroeconomic conditions, manifesting key turning points during certain critical periods.

6.3.2 Estimating a hybrid repeat sales model and the implied impact of Airbnb

Building upon the standard repeat sales model, this section constructs a hybrid repeated transactions model to investigate the influence of Airbnb on house prices. Differing from the traditional repeated sales model mentioned earlier, this research contends that the change in house price between two transactions not only depends on the characteristics of the house itself but also the shifts in the external environment, which the standard repeated sales model fails to capture.

The proportion of Airbnb rentals can reflect various factors such as the supply and demand conditions of residential property, tourist appeal, and community vibrancy in the neighbourhoods. These factors can, in turn, impact house prices.

Hence, this section utilises a hybrid model, treating the proportion of Airbnb rentals in the neighbourhood as the core explanatory variable. At the same time, the analysis controls for other variables that may potentially affect house prices, such as the interval between two transactions and the age of the property (Cannaday, Munneke, & Yang, 2005). The aim is to estimate price changes over time more accurately using the mixed model, whilst circumventing some limitations inherent in hedonic and repeated sales methods (Fogarty & Jones, 2011). The proportion of Airbnb rentals in a neighbourhood, a continuous variable, is denoted as "pct_air_home" in subsequent discussions.

Table 6-3 Hybrid repeat sales model baseline for all Airbnb properties.

	All		**Greater London**		**Greater Manchester**		**City of Bristol**	
Predictors	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
(Intercept)	2.364 ***	0.013	2.031 ***	0.013	2.314 ***	0.029	2.616 ***	0.055
pct_air_home	4.600 ***	0.058	1.594 ***	0.056	1.593 ***	0.254	-1.413 ***	0.357
ln(datebtwn)	-0.049 ***	0.001	-0.040 ***	0.001	-0.063 ***	0.001	-0.048 ***	0.002
dwe_modage	-0.001 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000
y1996	0.030 ***	0.001	0.048 ***	0.001	0.000	0.003	0.246 ***	0.020
y1997	0.150 ***	0.001	0.196 ***	0.001	0.027 ***	0.003	0.367 ***	0.020
y1998	0.271 ***	0.001	0.334 ***	0.001	0.083 ***	0.003	0.478 ***	0.020
y1999	0.395 ***	0.001	0.478 ***	0.001	0.125 ***	0.003	0.632 ***	0.020
y2000	0.571 ***	0.001	0.678 ***	0.001	0.219 ***	0.003	0.824 ***	0.020
y2001	0.681 ***	0.001	0.793 ***	0.001	0.317 ***	0.003	0.943 ***	0.020
y2002	0.833 ***	0.001	0.947 ***	0.001	0.477 ***	0.003	1.159 ***	0.020
y2003	0.973 ***	0.001	1.063 ***	0.002	0.696 ***	0.003	1.324 ***	0.020
y2004	1.081 ***	0.002	1.130 ***	0.002	0.918 ***	0.003	1.429 ***	0.020
y2005	1.130 ***	0.002	1.154 ***	0.002	1.047 ***	0.004	1.477 ***	0.020
y2006	1.193 ***	0.002	1.221 ***	0.002	1.105 ***	0.004	1.549 ***	0.020

y2007	1.310 ***	0.002	1.359 ***	0.002	1.167 ***	0.004	1.665 ***	0.020
y2008	1.312 ***	0.002	1.368 ***	0.002	1.152 ***	0.005	1.615 ***	0.021
y2009	1.215 ***	0.002	1.275 ***	0.002	1.034 ***	0.005	1.527 ***	0.021
y2010	1.285 ***	0.002	1.359 ***	0.002	1.064 ***	0.005	1.605 ***	0.021
y2011	1.297 ***	0.002	1.380 ***	0.002	1.045 ***	0.005	1.586 ***	0.021
y2012	1.335 ***	0.002	1.430 ***	0.002	1.045 ***	0.005	1.611 ***	0.021
y2013	1.394 ***	0.002	1.506 ***	0.003	1.057 ***	0.005	1.656 ***	0.021
y2014	1.514 ***	0.003	1.655 ***	0.003	1.111 ***	0.006	1.765 ***	0.022
y2015	1.585 ***	0.003	1.744 ***	0.003	1.157 ***	0.006	1.861 ***	0.022
y2016	1.656 ***	0.003	1.841 ***	0.003	1.216 ***	0.006	2.000 ***	0.022
y2017	1.681 ***	0.003	1.864 ***	0.003	1.272 ***	0.006	2.071 ***	0.022
y2018	1.685 ***	0.003	1.847 ***	0.003	1.328 ***	0.006	2.101 ***	0.023
y2019	1.685 ***	0.003	1.831 ***	0.003	1.370 ***	0.007	2.119 ***	0.023
Observations	1642557		1188519		378969		75069	
R^2 / R^2 adjusted	0.551 / 0.551		0.637 / 0.637		0.520 / 0.520		0.667 / 0.667	
AIC	2279362.810		1390543.524		547310.465		72816.719	
log-Likelihood	-304211.965		-61958.123		-107588.578		-261.212	

** p<0.05 ** p<0.01 *** p<0.001*

In Table 6-3, it presents the R^2, adjusted R^2, AIC, and log-likelihood from a mixed repeat sales model estimated using OLS. Relative to the standard model, there are improvements in these statistics, indicating a slightly enhanced model performance with an adjusted R-squared elevated to 55.1%. Moreover, the proportion of Airbnb properties in neighbourhood housing stock (pct_air_home), as well as covariables such as the days interval between two transactions (ln(datebtwn)) and the neighbourhood's era of construction (dwe_modage), all demonstrate statistical significance across all models. These findings suggest that as Airbnb penetrates neighbourhoods, it indeed has a significant impact on housing transaction prices. Hence, incorporating hedonic characteristics into the repeated sales model can better reflect Airbnb's influence and impact on property prices.

Considering the overall sample, the coefficient of the variable pct_air_home is positive and significant. This implies a premium of 4.71% (calculated as $e^{\left(\frac{4.6}{100}\right)}$-

1=4.707%) for a property located in a neighbourhood with a high proportion of Airbnb rentals compared to a property in a neighbourhood with a low Airbnb proportion. This is interesting from two perspectives. First, it reveals that the influence of Airbnb is capitalised into higher property prices: unless there is an excluded variable correlating with the Airbnb variable and provides an alternative explanation that Airbnb provides beneficial externalities, it seems reasonable to assume that repurposing housing for Airbnb use causes an increase in housing prices. Second, these results highlight the utility of including hedonic characteristics in a repeat sales model. By incorporating the pct_air_home variable, which captures Airbnb's impact on house prices, the model provides more insights into the real estate market.

To further explore the influence of Airbnb on house prices in specific cities, regression analyses on three separate samples were conducted: Greater London, Greater Manchester, and Bristol.

For the Greater London sample, the coefficient of the variable pct_air_home is positive and significant, indicating a significant positive correlation between an increase in the prevalence of Airbnb in Greater London and a rise in house prices. For every one percentage point increase in the proportion of Airbnb rentals in a neighbourhood, the average house price in Greater London increases by 1.61% (calculated as $e^{\left(\frac{1.594}{100}\right)}$-1=1.606%). This result is consistent with our previous findings, suggesting that Airbnb has a positive effect on house prices in high-income, high-population density, and high-tourism-demand cities.

The sample from Greater Manchester also reveals a positive and significant coefficient for the pct_air_home variable. Every 1% of housing used for Airbnb leads to an average increase in house prices in Greater Manchester by 1.61% (calculated as $e^{\left(\frac{1.593}{100}\right)}$-1=1.605%), an effect parallel to that in Greater London. This could imply that Airbnb has a similar impact mechanism in other major cities in the UK. Manchester has long suffered from a housing supply shortage (Timan, 2022), with house prices slightly lower than Greater London but rapidly rising in recent years. Thus, Airbnb further exacerbates this escalation in price levels.

For the Bristol sample, the coefficient of the variable pct_air_home is -1.413 and significantly so. Here, a one percentage point increase in Airbnb rentals in the housing stock leads to a decline in Bristol's average house price by approximately 1.4% (calculated as $e^{\left(-\frac{1.413}{100}\right)}$-1=-1.403%). This implies that Airbnb's impact can differ substantially, even inversely, in different regions and city types. A plausible explanation is that Bristol, being a smaller city with lower tourism demand, has a lower Airbnb penetration ratio, and its housing market has not significantly felt the impact of Airbnb-induced supply strain and tourism revenue. In contrast to Greater London and Greater Manchester, Bristol may place a higher premium on its community and historical heritage, perceiving the rise of Airbnb as a threat.

Hence, the negative effects Airbnb brings to neighbourhood ambiance and community cohesion may have led to the decline in house prices. Also, the OLS regression analysis did not capture the heterogeneity of influencing factors at a micro-region level, indicating a need to further examine the effects at a finer scale.

In summary, an examination of the data reveals that Airbnb's impact on housing prices across various UK cities is not uniform, but rather varies significantly. This variation appears to be influenced by factors such as the size of the city and the level of tourism demand. These findings contribute to a more comprehensive understanding of Airbnb's role in the housing market. They also serve as a valuable resource for those seeking to evaluate the platform's influence on property prices.

6.3.2.1 The implied impact of different types of Airbnb properties on house prices

This section further differentiates the proportion of various types of Airbnb properties, mainly houses and flats, in the hybrid repeat sales model to explore whether different types of Airbnb properties impact house prices differently. The proportion of different types of Airbnb properties reflects users' different preferences for housing types and potential location requirements during short-term rentals, hence there is differing impact on house prices. They are continuous variables, represented as "pct_air_house" and "pct_air_flat" for houses and flats, respectively. Specifically, if a neighbourhood has a higher proportion of Airbnb houses, it indicates that short-term renters in that area prefer to rent whole houses, potentially valuing privacy and autonomy. On the other hand, the neighbourhoods with a high proportion of Airbnb flats suggest renters value convenient locations and comprehensive amenities. As these two groups of users have varying location preferences, their impacts on house prices can also differ. It is thus worthwhile to conduct empirical studies on the impact of different types of Airbnb properties on house prices in Greater London, Greater Manchester, and Bristol, the results of which are shown in Table 6-4.

Table 6-4 Hybrid repeat sales model with different types of Airbnb properties.

	All		**Greater London**		**Greater Manchester**		**City of Bristol**	
Predictors	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
(Intercept)	2.329 ***	0.013	2.001 ***	0.013	2.310 ***	0.029	2.609 ***	0.055
pct_air_house	1.441 ***	0.035	0.712 ***	0.033	-0.406 **	0.129	-0.320	0.254
pct_air_flat	3.211 ***	0.041	1.679 ***	0.041	1.755 ***	0.120	0.130	0.145
ln(datebtwn)	-0.050 ***	0.001	-0.040 ***	0.001	-0.063 ***	0.001	-0.049 ***	0.002

dwe_modage	-0.001 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000
y1996	0.031 ***	0.001	0.048 ***	0.001	0.000	0.003	0.246 ***	0.020
y1997	0.150 ***	0.001	0.196 ***	0.001	0.027 ***	0.003	0.367 ***	0.020
y1998	0.272 ***	0.001	0.335 ***	0.001	0.083 ***	0.003	0.478 ***	0.020
y1999	0.397 ***	0.001	0.480 ***	0.001	0.125 ***	0.003	0.632 ***	0.020
y2000	0.572 ***	0.001	0.680 ***	0.001	0.220 ***	0.003	0.824 ***	0.020
y2001	0.682 ***	0.001	0.795 ***	0.001	0.318 ***	0.003	0.944 ***	0.020
y2002	0.836 ***	0.001	0.949 ***	0.001	0.478 ***	0.003	1.159 ***	0.020
y2003	0.976 ***	0.001	1.065 ***	0.002	0.696 ***	0.003	1.325 ***	0.020
y2004	1.084 ***	0.002	1.132 ***	0.002	0.918 ***	0.003	1.429 ***	0.020
y2005	1.133 ***	0.002	1.156 ***	0.002	1.047 ***	0.004	1.477 ***	0.020
y2006	1.196 ***	0.002	1.224 ***	0.002	1.105 ***	0.004	1.550 ***	0.020
y2007	1.314 ***	0.002	1.361 ***	0.002	1.168 ***	0.004	1.666 ***	0.020
y2008	1.316 ***	0.002	1.371 ***	0.002	1.153 ***	0.005	1.616 ***	0.021
y2009	1.220 ***	0.002	1.279 ***	0.002	1.035 ***	0.005	1.528 ***	0.021
y2010	1.290 ***	0.002	1.362 ***	0.002	1.064 ***	0.005	1.606 ***	0.021
y2011	1.302 ***	0.002	1.384 ***	0.002	1.046 ***	0.005	1.587 ***	0.021
y2012	1.335 ***	0.002	1.431 ***	0.002	1.045 ***	0.005	1.612 ***	0.021
y2013	1.392 ***	0.002	1.505 ***	0.003	1.057 ***	0.005	1.657 ***	0.021
y2014	1.510 ***	0.002	1.652 ***	0.003	1.111 ***	0.006	1.766 ***	0.022
y2015	1.579 ***	0.003	1.740 ***	0.003	1.156 ***	0.006	1.861 ***	0.022
y2016	1.650 ***	0.003	1.835 ***	0.003	1.215 ***	0.006	1.999 ***	0.022
y2017	1.675 ***	0.003	1.856 ***	0.003	1.271 ***	0.006	2.068 ***	0.022
y2018	1.680 ***	0.003	1.839 ***	0.003	1.326 ***	0.006	2.096 ***	0.022
y2019	1.682 ***	0.003	1.823 ***	0.003	1.368 ***	0.007	2.112 ***	0.023
Observations	1642557		1188519		378969		75069	
R^2 / R^2 adjusted	0.553 / 0.553		0.638 / 0.638		0.521 / 0.521		0.667 / 0.667	

AIC	2273146.390	1387893.415	547136.335	72832.360
log-Likelihood	-301102.755	-60632.069	-107500.513	-268.032

** p<0.05 ** p<0.01 *** p<0.001*

Compared to the baseline model that only considers the overall proportion of Airbnb, the hybrid repeat sales model shows further improvements in its R^2, adjusted R^2, AIC, and log-likelihood, slightly enhancing the model's explanatory power. The proportions of different types of Airbnb properties in the neighbourhood housing stock (pct_air_house and pct_air_flat) have statistically significant coefficients with observable differences in different sample models. Covariates such as the days interval between two transactions (ln(datebtwn)), the era of neighbourhood construction (dwe_modage), as well as time dummy variables maintain consistent regression coefficients and significance levels as with the previous model. This indicates that as Airbnb permeates neighbourhoods, different types of Airbnb properties exert differentiated mechanisms of influence on housing transaction prices, possibly related to the varying impacts these property types have on neighbourhood externalities.

From the overall sample, both pct_air_house and pct_air_flat variable's regression coefficients were positive and significant, indicating that whether house or flat type properties are used as Airbnb rentals, they significantly contribute to housing price inflation. Properties located in neighbourhoods with a high proportion of house-type Airbnb properties have a premium of 1.45% (calculated as $e^{\left(\frac{1.441}{100}\right)}$-1=1.451%), and similarly, properties in neighbourhoods with a high proportion of flat-type Airbnb properties have a premium of 3.26% (calculated as $e^{\left(\frac{3.211}{100}\right)}$-1=3.263%). This indicates that when flat-type properties are used as short-term rental accommodation, the impact on housing transaction prices is larger, likely around twice that of house-types. Overall, the demand for flat-type properties outweighs that for house-types. For smaller travel groups and individual travellers, the cost of renting an entire house can be prohibitively high, while flat-type properties offer more affordable and flexible options (Cheung & Yiu, 2021). Airbnb short-term rentals appeal to this broad spectrum of short-term housing demand. Moreover, flat-type properties are often located closer to city centres and tourist attractions, thus directly serving tourism accommodation needs and exerting stronger upward pressure on surrounding house prices. In contrast, house-type properties cater to larger families or groups and have limited demand volumes. Therefore, from both supply and demand perspectives, flat-type properties exert a greater influence on house prices.

The regression analyses of the samples from Greater London, Greater Manchester, and Bristol revealed a number of notable observations. From the Greater London sample, the regression coefficients of both the pct_air_house and

pct_air_flat variables are positive and significant. Given that Greater London has the highest sample volume, whether house or flat type properties are used as Airbnb rentals, the resultant inflation in housing prices is mainly driven in London. Houses located in neighbourhoods with a high proportion of house-type Airbnb properties have a premium of 0.71% (calculated as $e^{\left(\frac{0.712}{100}\right)}$-1=0.714%), and similarly, those in neighbourhoods with a high proportion of flat-type Airbnb properties have a premium of 1.69% (calculated as $e^{\left(\frac{1.679}{100}\right)}$-1=1.693%). These findings align with those from the full sample. They suggest that whether house or flat type properties are used for Airbnb, there is an overall increase in house prices, likely due to a high penetration rate of Airbnb rental activity in Greater London and a large influx of both types of Airbnb tenants and landlords. However, these phenomena are based solely on the Greater London sample and may not apply to other regions.

From the Greater Manchester sample, the regression coefficient of the pct_air_flat variable is positive and significant, while the pct_air_house variable's coefficient is negative and significant. This suggests rather different outcomes in Greater Manchester's sample. For every one percentage point increase in the proportion of flat-type Airbnb rentals in a neighbourhood, properties in that neighbourhood have a premium of 1.69% (calculated as $e^{\left(\frac{1.679}{100}\right)}$ -1=1.693%). Conversely, for every one percentage point increase in the proportion of house-type Airbnb rentals, properties in that neighbourhood experience a devaluation of 0.405% (calculated as $e^{\left(\frac{-0.406}{100}\right)}$ -1=-0.405%). The inflationary effect of flat type properties being used as Airbnb rentals in Greater Manchester is highly significant, even surpassing that observed in Greater London. The practice of converting flat-type properties into Airbnb accommodations has resulted in a supply-demand imbalance in the Greater Manchester region (Silver, 2018). Meanwhile, house-type properties being used as Airbnb rentals exert a significant downward pressure on housing prices in the Greater Manchester area. Users who rent whole houses may value the stability and tranquillity of neighbourhoods, and the fluidity of Airbnb short-term rentals disrupts these neighbourhood traits, leading to a devaluation of the "ground value." Thus, due to the differences in demand structure between these types of users, the influences of the two types of properties differ.

From the Bristol sample, the regression coefficient of the pct_air_flat variable is positive, and the pct_air_house variable is negative, but neither is significant. This implies that the use of flat-type properties as Airbnb rentals only appreciates property values in certain areas of Bristol, while house-type Airbnb rentals only depreciate property values in some housings. In terms of different types of Airbnb rentals, there is no widespread impact on housing transaction prices. This may be because the property market in Bristol is complex and diverse (Boddy, 2007).

Airbnb only has considerable driving-up effects on house prices in areas with certain specific characteristics, such as student-dense or rural areas.

To sum up, different types of Airbnb have disparate impacts on house prices in various UK cities. Prices are primarily driven up by flat-type Airbnb properties, while house-type Airbnb properties may slightly decrease house prices (Shabrina, Arcaute, & Batty, 2021). In cities with smaller population mobility, the impact of Airbnb could be more localised. This reflects the regional differences among different types of Airbnb properties. Therefore, Airbnb should not be simplistically viewed as a consolidated whole, but instead differentiate among the impacts of different types of properties. The housing market structures and features of different cities vary greatly, as do the target groups and positioning of different types of Airbnb properties. These micro factors cumulatively influence the impact of Airbnb on neighbourhood house prices, and it is vital to take a more comprehensive view to understand this issue.

6.3.2.2 The implied impact of Airbnb properties with different bedroom numbers on house prices

This section further distinguishes the proportion of Airbnb properties with different bedroom numbers in the hybrid repeat sales model, mainly divided into one-bedroom, two-bedroom, three-bedroom and above four-bedroom properties, to explore whether the impact of different numbers of bedrooms Airbnb on house prices varies. The proportion of Airbnb properties with different bedroom numbers reflects the different preferences and needs of users in choosing short-term accommodation in terms of housing size and living standards, which may have different effects on house prices. They are continuous variables, which are expressed as "pct_air_bdr1", "pct_air_bdr2", "pct_air_bdr3", "pct_air_bdr4" for different numbers of bedrooms. Specifically, if a neighbourhood has a high proportion of smaller size Airbnb properties, this indicates that the short-term rental users in this area prefer to rent smaller houses, which may be more economical, convenient and flexible. On the other hand, neighbourhoods with a high proportion of bigger size Airbnb properties indicate that users value space and comfort more, which may suit larger groups of guests or longer stays. The travel purpose and demand preference of choosing different size short-term rental properties are different, and the impact mechanism on house prices will also be different. This section empirically analyses the impact of Airbnb properties with different bedroom numbers on residential transaction prices in three cities. The results are shown in Table 6-5:

Table 6-5 Hybrid repeat sales model with different bedroom numbers of Airbnb properties.

	All		Greater London		Greater Manchester		City of Bristol	
Predictors	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
(Intercept)	2.284 ***	0.013	1.982 ***	0.013	2.300 ***	0.029	2.509 ***	0.056
pct_air_bdr1	1.514 ***	0.032	0.843 ***	0.033	0.387 ***	0.087	-0.046	0.099
pct_air_bdr2	2.562 ***	0.052	1.074 ***	0.052	1.647 ***	0.186	0.879 ***	0.255
pct_air_bdr3	-0.811 ***	0.051	-0.022	0.065	-0.406 ***	0.083	-2.281 ***	0.348
pct_air_bdr4	1.460 ***	0.033	0.704 ***	0.032	0.559 ***	0.116	1.147 ***	0.121
ln(datebtwn)	-0.050 ***	0.001	-0.040 ***	0.001	-0.063 ***	0.001	-0.048 ***	0.002
dwe_modage	-0.001 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000	-0.001 ***	0.000
y1996	0.031 ***	0.001	0.048 ***	0.001	0.000	0.003	0.246 ***	0.020
y1997	0.151 ***	0.001	0.196 ***	0.001	0.027 ***	0.003	0.367 ***	0.020
y1998	0.272 ***	0.001	0.335 ***	0.001	0.083 ***	0.003	0.478 ***	0.020
y1999	0.397 ***	0.001	0.480 ***	0.001	0.125 ***	0.003	0.633 ***	0.020
y2000	0.573 ***	0.001	0.680 ***	0.001	0.220 ***	0.003	0.824 ***	0.020
y2001	0.683 ***	0.001	0.795 ***	0.001	0.318 ***	0.003	0.944 ***	0.020
y2002	0.836 ***	0.001	0.950 ***	0.001	0.478 ***	0.003	1.160 ***	0.020
y2003	0.977 ***	0.001	1.066 ***	0.002	0.697 ***	0.003	1.325 ***	0.020
y2004	1.085 ***	0.002	1.133 ***	0.002	0.918 ***	0.003	1.430 ***	0.020
y2005	1.134 ***	0.002	1.157 ***	0.002	1.047 ***	0.004	1.478 ***	0.020
y2006	1.198 ***	0.002	1.224 ***	0.002	1.106 ***	0.004	1.550 ***	0.020
y2007	1.315 ***	0.002	1.362 ***	0.002	1.168 ***	0.004	1.666 ***	0.020
y2008	1.317 ***	0.002	1.372 ***	0.002	1.153 ***	0.005	1.616 ***	0.021
y2009	1.221 ***	0.002	1.279 ***	0.002	1.035 ***	0.005	1.529 ***	0.021
y2010	1.292 ***	0.002	1.363 ***	0.002	1.065 ***	0.005	1.606 ***	0.021
y2011	1.303 ***	0.002	1.385 ***	0.002	1.047 ***	0.005	1.587 ***	0.021
y2012	1.336 ***	0.002	1.432 ***	0.002	1.046 ***	0.005	1.612 ***	0.021
y2013	1.392 ***	0.002	1.505 ***	0.003	1.057 ***	0.005	1.656 ***	0.021

y2014	1.509 ***	0.002	1.651 ***	0.003	1.111 ***	0.006	1.764 ***	0.022
y2015	1.577 ***	0.003	1.738 ***	0.003	1.156 ***	0.006	1.858 ***	0.022
y2016	1.647 ***	0.003	1.832 ***	0.003	1.216 ***	0.006	1.995 ***	0.022
y2017	1.671 ***	0.003	1.853 ***	0.003	1.271 ***	0.006	2.063 ***	0.022
y2018	1.675 ***	0.003	1.835 ***	0.003	1.327 ***	0.006	2.090 ***	0.022
y2019	1.676 ***	0.003	1.818 ***	0.003	1.368 ***	0.007	2.105 ***	0.023
Observations	1642557		1188519		378969		75069	
R^2 / R^2 adjusted	0.554 / 0.554		0.638 / 0.638		0.521 / 0.521		0.668 / 0.668	
AIC	2269872.117		1386922.436		547180.329		72680.876	
log-Likelihood	-299463.618		-60144.579		-107520.510		-190.290	

** p<0.05 ** p<0.01 *** p<0.001*

Compared to the benchmark model that considers only the overall Airbnb proportion, the hybrid repeat sales model shows a slight improvement in statistical measures including R^2, adjusted R^2, AIC, and log-Likelihood. This advancement aids in increasing the explanatory power of the model. The proportions of Airbnb properties with differing bedroom numbers ("pct_air_bdr1", "pct_air_bdr2", "pct_air_bdr3", and "pct_air_bdr4") in the neighbourhood housing stock possess significant statistical relevance with most regression coefficients in all models. Covariates such as the interval between two transactions (ln(datebtwn)), the year of construction in the neighbourhood (dwe_modage), as well as the regression coefficients and significance of the time dummy variable, remain largely consistent with prior models, contributing positively to model stability. This denotes that as Airbnb matures in market competition, Airbnb listings with different bedroom numbers are initiating varied influence mechanisms on housing transaction prices. This may relate to factors such as target customer demographics and pricing strategies.

When considering the entire sample, the regression coefficients for variables "pct_air_bdr1", "pct_air_bdr2", and "pct_air_bdr4" are significant and positive; the coefficient for "pct_air_bdr3", however, is notably negative. This demonstrates the profound effect of small-sized properties, such as one- & two-bedroom houses, offered as short-term rentals on housing transaction prices. For every percentage point increase in the proportion of one-bedroom Airbnb properties in a neighbourhood, the houses located within that area gain a premium of 1.53% ($e^{\left(\frac{1.514}{100}\right)}$-1=1.526%); the figure stands at 2.60% ($e^{\left(\frac{2.562}{100}\right)}$-1=2.595%) for two-bedroom properties. This suggests a high demand for smaller properties in the short-term

rental market, generating a significant push on housing prices. On the other hand, larger properties – those with more than four bedrooms – also exhibit a tangible influence on housing transaction prices when utilised as short-term rentals. Each percentage point increase in the proportion of these properties in a neighbourhood sees a 1.47% ($e^{\left(\frac{1.460}{100}\right)}$-1=1.471%) price premium on properties in that neighbourhood. This indicates a certain demand for larger properties within the short-term rental market and a resultant positive impact on transaction prices. However, three-bedroom houses, which are typically sought out by families, generate a decrease in housing prices when utilised as short-term rentals. A percentage point increase in the proportion of three-bedroom Airbnb properties sees a 0.81% ($e^{\left(-\frac{0.811}{100}\right)}$-1=-0.807%) price reduction. This could be due to three-bedroom properties being better suited for private rental living arrangements, rather than short-term rentals, hence causing a negative impact on housing prices.

The analysis of individual regression results from the samples garnered from Greater London, Greater Manchester, and Bristol revealed some intriguing and distinct phenomena.

For Greater London, the regression coefficients and significance of variables "pct_air_bdr1", "pct_air_bdr2", and "pct_air_bdr4" are aligned principally with the overall sample. This consistency indicates that the large sample size from Greater London has shaped this pattern. For each percentage point increase in one-bedroom Airbnb properties within a neighbourhood, properties therein experience a price premium of 0.85% ($e^{\left(\frac{0.843}{100}\right)}$-1=0.847%). A similar trend is observed with two-bedroom properties, with a 1.08% ($e^{\left(\frac{1.074}{100}\right)}$-1=1.078%) price increase. This signifies that smaller properties meet most tourists' budgetary and usage needs, and housing prices in commercial districts are driven up by reduced supply and the spillover effect from tourism. Additionally, larger properties with above four bedrooms offered for short-term rentals also have a ubiquitous impact on housing transaction prices. Specifically, there is a 0.71% ($e^{\left(\frac{0.704}{100}\right)}$-1=0.706%) price premium if the proportion of such properties increases by each percentage point in the neighbourhood. These types of properties might provide extra space or facilities that meet the needs of social gatherings, making them appealing to short-term rental users. However, for three-bedroom properties, often ideal for families, the analysis shows a devaluation in housing prices when these are offered as short-term rentals. Although this trend is not statistically significant, it might exist because the short-term rental market in Greater London is dominated by short-term tourists and business travellers (Xu et al., 2020), with relatively fewer families choosing to rent these types of properties via the Airbnb platform. Therefore, even if there is a negative impact, it's not universal.

Considering the sample from Greater Manchester, the regression coefficients and significance of variables "pct_air_bdr1", "pct_air_bdr2", and "pct_air_bdr4" are

in general alignment with the overall sample data, indicating that Manchester follows the overall pattern of Airbnb's impact on housing prices. Each percentage point increase in the neighbourhood's one-bedroom Airbnb properties equates to a property price premium of 0.39% ($e^{\left(\frac{0.387}{100}\right)}$-1=0.388%), while two-bedroom properties command a price premium of 1.66% ($e^{\left(\frac{1.647}{100}\right)}$-1=1.661%). This highlights the popularity and suitability of two-bedroom houses for families or group travels. Similarly, larger properties with more than four bedrooms used as short-term rentals have a tangible influence on housing prices, marking a price premium of 0.561% ($e^{\left(\frac{0.559}{100}\right)}$-1=0.561%) with each percentage point increase. These types of properties are relatively scarce in Manchester, and their repurposing for Airbnb rentals reduces market supply, consequently pushing up prices. The only exception is three-bedroom properties, which when offered as short-term rentals cause a decrease in housing prices — a 0.405% ($e^{\left(-\frac{0.406}{100}\right)}$-1=-0.405%) drop with each percentage point increase. Therefore, in Manchester, the price premium effect from two-bedroom properties is significantly higher than that from one-bedroom and above four-bedroom properties. Two-bedroom homes are the primary choice for local families making them an integral part of the housing market. The reduction in this type of property hits middle-class buying demands hardest, consequently causing a broader price rise. The effect of above four-bedroom Airbnb properties is also slightly higher in Manchester than that of one-bedroom properties due to a local shortage of this type of accommodation. Finally, the devaluation impact on housing prices caused by three-bedroom properties is significant in Manchester. This might be due to the increase of mobility from transient populations in communities where these properties are rented, degrading neighbourhood stability and affecting the buying decisions of prospective homeowners (Silver, 2018), thus weakening the demand.

In terms of Bristol, there is a significant positive regression coefficient for the variables "pct_air_bdr2" and "pct_air_bdr4", a significant negative coefficient for "pct_air_bdr3", and a negative but not significant one for "pct_air_bdr1". These results reflect considerable variances in the types of housing units impacted by Airbnb in Bristol's housing market. With each percent increase in the proportion of two-bedroom Airbnb listings in a neighbourhood, properties in that area can command a price premium of 0.883% ($e^{\left(\frac{0.879}{100}\right)}$-1=0.883%), significantly lower than Greater London and Greater Manchester. On the other hand, the price impact of above four-bedroom houses being rented short-term is substantial. With each percentage point increase in these listings, other properties in the neighbourhood experience a price premium of 1.15% ($e^{\left(\frac{1.147}{100}\right)}$-1=1.154%), which is noticeably higher than in the other two regions. This implies that Airbnb has a larger impact on the high-end market in Bristol. The three-bedroom houses listed as short-term rentals

on Airbnb cause significant depreciation. Each percent increase in these listings results in a 2.26% ($e^{\left(-\frac{2.281}{100}\right)}$-1=-2.255%) price reduction for other properties in the same neighbourhood, much higher than either Greater London or Greater Manchester. Despite a slight negative impact on housing prices from one-bedroom Airbnb listings, this change is not significant. In Bristol, the price premium effect of above four-bedroom listings is higher than those of two-bedroom homes, and significantly so compared to the other two regions. This discrepancy is probably because Bristol boasts a vibrant tourism sector, and the larger properties cater well to group tourists and families on vacation (Kelly, 2001). Simultaneously, Bristol's many universities make these larger properties convenient for students and visiting academics, fuelling demand for above four-bedroom properties. The impact of one-bedroom Airbnb properties on Bristol's housing market is negligible, likely because there is less of a demand for single travel or business short-term accommodations in the city (Visit Wiltshire, 2018). The substantial reduction in prices caused by three-bedroom homes listed on Airbnb in Bristol suggests that a high proportion of these properties being offered as short-term rentals is negatively affecting the quality of life and satisfaction of local residents (Airbnb, 2022b), thus decreasing potential buyers' willingness and ability to purchase.

In summary, different bedroom numbers of Airbnb listings affect housing prices across the UK cities in varied ways. This impact likely depends on the direction of tourism development, types of housing supply, and residential habits of the local population. Smaller Airbnb listings mainly drove up housing prices, with two-bedroom Airbnb homes having the most noticeable effect, closely followed by one-bedroom properties (Calder-Wang, 2019). Some people opt for large Airbnb listings, specifically in vacation destinations, as an alternative to hotels, using this space as a base during their travels. Hence, the impact of the high-end Airbnb market with above four-bedroom units on housing prices is significant (Cheung & Yiu, 2022). However, the trend of offering three-bedroom homes as Airbnb listings could slightly drive down property prices, reducing the attractiveness of surrounding residences. These findings reflect the heterogeneous effects of Airbnb listings with different numbers of bedrooms. Consequently, one can't view Airbnb as a monolithic entity; instead, the effects of properties with different numbers of bedrooms should be assessed individually. Different types of Airbnb listing scales have varying impacts on housing prices (Benítez-Aurioles & Tussyadiah, 2021), with local community structure and economic characteristics differing amongst cities. City governments should implement measures adjusted to the local circumstances, guiding the development of their local Airbnb market in a manner that balances tourism development and residents' interests.

6.4 Summary and Conclusion

The examination of Airbnb property listings within various regions of the UK reveals that Airbnb penetration rate did influence neighbourhood house prices. It also suggests a substantial impact on diverse housing sub-markets, from geographic location to property type.

Starting with the heart of the United Kingdom, Central London, a high concentration of long-term Airbnb listings is discovered. The prevalence of such properties dropping in suburban neighbourhoods located approximately 10km from the city centre, the overall quantity distribution across the capital indicates a robust presence of Airbnb within the housing landscape. Previous research has found that more than 2% of all properties in London are misused as short-term holiday rentals (Shabrina, Arcaute, & Batty, 2021), our study shows similar results (2% to 10%) and this figure could be up to 14% in some areas. This scenario raises the possibility that Airbnb's influence has arguably displaced long-term rentals, instigating substantial change within London's traditional long-term rental market.

As the attention shifted northwards to Manchester, the landscape was somewhat different. Here, Airbnb penetration is more limited (2% to 4% of the total housing stock in the Manchester city centre) and specific to property size, yet it carries implications substantial enough to raise concerns over housing availability and affordability. In particular, smaller-sized Airbnb properties figure prominently in specific city centre neighbourhoods. This trend supports the view that the housing financialisation puts pressure on the supply of housing for long-term residents inside and outside the Manchester city-regional centre (Silver, 2018).

The story unfolds similarly in Bristol as Greater Manchester albeit it is a smaller city. The analysis shows that the percentage of entire home taken by Airbnb in this city falls mid-range (1% to 2%) when compared to the vast markets of Greater London and Greater Manchester. It displays increased competition in the local accommodation market (Voltes-Dorta & Inchausti-Sintes, 2020) with Airbnb penetrating more in the high end market in specific neighbourhoods, indicating a more pronounced prevalence of short-term rentals for larger, upscale properties in smaller city contexts.

Analysing the types of properties prevalent on Airbnb provides further insight into the dynamics of this short-term rental market. Flats consistently register a higher level of Airbnb penetration and a significant impact on neighbourhood housing prices in both Greater London and Greater Manchester, this is also the case in New York (Yeon et al., 2020) and Melbourne (Cheung & Yiu, 2022). It is plausible this tendency is attributable to the relative ease of converting flats into short-term rentals. Li et al. (2022) also suggested this could be because flats have lower fixed costs for listing on Airbnb compared to houses. On the flip side, entire houses used as short-term rentals may pose negative externalities and reduce neighbourhood housing prices in smaller sized cities.

In terms of property sizes, smaller Airbnb properties show a prominent concentration in city centres and a significant promoting impact on neighbourhood housing prices (Chaudhary, 2021). Meanwhile, their high-end counterparts – properties boasting more than four bedrooms – tend to be more scattered and dispersed, also have a positive impact. The mid-end three-bedroom Airbnb is the only size that has a lowering impact on neighbourhood housing prices. The case is slightly different in Boston that homes with two or more bedrooms are potentially affected by Airbnb due to the fact that renting out entire units with multi-bedrooms is more common there (Horn & Merante, 2017).

These varied penetration rates and impacts reflect the differential opportunities for accommodating short-term lets in each locale (Chattopadhyay & Mitra, 2019). The built environment, local amenities, and the existing housing stock inventory all interplay to yield distinct Airbnb penetration rates in different neighbourhoods. Therefore, mapping the trajectory of Airbnb's influence on housing markets necessitates a more nuanced understanding of these spatially determined dynamics.

CHAPTER 7
FROM HETEROGENEOUS IMPACTS OF PROFESSIONALISED PEER-TO-PEER ACCOMMODATION TO RESIDENTIAL GENTRIFICATION

7.1 Introduction

Due to the uneven distribution of urban spatial resources, sample cities exhibit varying resource endowments, geographical advantages, and socio-economic development levels. Significant disparities exist between residential sub-markets across cities. Within the scope of the short-term rental, its impact on neighbourhood housing prices displays dynamics across districts, and there may be localised variations even among adjacent neighbourhoods (Garcia-López et al., 2020; Franco & Santos, 2021).

As stated by many studies (Stergiou & Farmaki, 2020; Agustin Cocola-Gant et al., 2021), the impacts of short-term rental on neighbourhoods are multifaceted. Potential revenue stream lures investors and speculative buyers, translating into inflated sales prices. The knock-on effect is a squeeze on long-term housing supply, which reverberates onto housing accessibility and affordability (Barron, Kung, & Proserpio, 2020). On the other hand, an influx of Airbnb guests can create nuisance and irritation for residents (Wyman, Mothorpe, & McLeod, 2020). High concentrations of Airbnb guests in specific neighbourhoods can lead to undesirable effects such as excess noise, overcrowding, and a dilution of community spirit, which may discourage long-term residents. As a result, while city-wide rents might increase due to a thinning housing supply, housing prices in Airbnb-dense neighbourhoods may actually dip as residents seek to avoid these potential drawbacks. Therefore, while P2P accommodation platforms have paved the way for diverse opportunities for property owners, they also bring about complexities in the housing market and local communities (Bao & Shah, 2020).

The repeat sales model in Chapter 6 relied on ordinary linear regression, which failed to account for the heterogeneity of Airbnb's impact across different neighbourhoods, instead calculating only the average effect. Therefore, it is needed to consider the neighbourhood effect within the residential market when examining the influence (Deboosere et al., 2019). To accurately capture this heterogeneity, a multi-level model can be employed to investigate Airbnb's differential effects across various neighbourhoods. To date, limited research has utilised this model to explore the spatial expression of neighbourhood heterogeneity in the context of short-term rental impacts.

In fact, the previous chapter has identified clues regarding the impact of short-term rentals on neighbourhood housing price fluctuations. The increase in short-term rentals reflects a rising speculative demand for housing in the market, which often results in increased residential mobility—a common indicator of early gentrification (Silver, 2018). The rise in property prices and rents leads to the displacement of low-income residents and the influx of high-income groups, which is a factor contributing to demographic shifts (Mermet, 2022). Furthermore, the proliferation of short-term rentals disrupts community continuity and social networks, resulting in the loss of long-term residents and frequent changes of community members (Prayag & Ozanne, 2018). Thus, both short-term rentals themselves and the changes in housing costs within neighbourhoods can catalyse social structural transformations that prompt gentrification. Residential mobility serves as a crucial social indicator for assessing the risk of gentrification within neighbourhoods.

In light of these issues, the main objective of this chapter is to examine the heterogeneous impact of the P2P accommodation on neighbourhood housing prices and the risks of gentrification experienced by neighbourhoods. By incorporating empirical evidence from a variety of geographical settings, the chapter further explores the impact of different types and sizes of Airbnb properties on local housing affordability from a spatial perspective. Finally, through spatial and statistical methods, the chapter explores how P2P accommodation and residential mobility interact in different gentrification contexts, particularly in deprived neighbourhoods.

7.2 The neighbourhood variation of the impact of professionalised Airbnb

The previous analysis only examines the impact of neighbourhood Airbnb penetration on housing transaction prices in a general sense, without considering the inherent variation between different neighbourhoods. This section revisits the analysis through the lens of a multilevel model, treating the proportion of entire home Airbnb properties in a neighbourhood as random slopes, to examine the heterogeneity of Airbnb's influence on housing prices between neighbourhoods. It is commonly accepted that real estate prices and their determining factors fluctuate continuously on a spatial scale. However, urban spaces are discretized into units based on transportation routes, housing stock, and land use. These units, which are hierarchically nested, suggest that real estate prices and their influencing factors operate on multiple spatial and administrative levels. Standard OLS models, while simplistic, fail to consider average changes between groups and heteroscedasticity problems caused by omitted variables and between-group heterogeneity. Conducting sub-sample regressions between each local area would face sampling problems and poor generalisability. To model the housing market effectively, it is necessary to specify different levels in the characteristic variables

explicitly. Unlike the standard repeat-sales model, a multilevel modelling design can capture heteroscedasticity caused by common misspecifications (Todd, Musah, & Cheshire, 2021), such as those arising from extracting attributes from groups with non-constant variance. This modelling technique, which examines the effects of hierarchically nested groups, has been widely employed to explain geographical heterogeneity and hierarchical structures in spatial data (Chi et al., 2020; Choi, Park, & Dewald, 2021).

Given the considerable disparities in economic development and resource assets amongst the three primary cities under study, a multilevel model has been employed to investigate whether Airbnb's impact on housing prices exhibits regional and local variations. The multilevel modelling approach utilises the UK's census statistical unit LSOA as the identifier for neighbourhood groups, setting housing transaction prices as the individual level (level 1) and the proportion of Airbnb listings as the neighbourhood level (level 2). By nesting attributes within each neighbourhood, heterogeneity between adjacent house values was addressed, enabling us to explore whether Airbnb's penetration and its impact on housing transaction prices exhibit heterogeneity across different urban regions.

7.2.1 Neighbourhood heterogeneity in the implied impact of Airbnb on house prices

With the multi-level model approach, an empirical analysis was conducted on the impact of housing transaction prices across a full sample of three cities. After numerous iterations, the model converged, with the estimated results of the multi-level regression model as shown in Table 7-1.

Table 7-1 Hybrid repeat sales multi-level model for all Airbnb properties.

	All	
Predictors	*B*	*SE*
(Intercept)	1.991 ***	0.050
pct_air_home	14.918 ***	0.433
ln(datebtwn)	-0.050 ***	0.001
dwe_modage	-0.001 ***	0.000
y1996	0.031 ***	0.001
y1997	0.153 ***	0.001
y1998	0.274 ***	0.001
y1999	0.399 ***	0.001

y2000	0.574 ***	0.001
y2001	0.685 ***	0.001
y2002	0.837 ***	0.001
y2003	0.978 ***	0.001
y2004	1.087 ***	0.002
y2005	1.136 ***	0.002
y2006	1.200 ***	0.002
y2007	1.319 ***	0.002
y2008	1.321 ***	0.002
y2009	1.223 ***	0.002
y2010	1.294 ***	0.002
y2011	1.306 ***	0.002
y2012	1.344 ***	0.002
y2013	1.404 ***	0.002
y2014	1.524 ***	0.002
y2015	1.592 ***	0.003
y2016	1.663 ***	0.003
y2017	1.685 ***	0.003
y2018	1.686 ***	0.003
y2019	1.681 ***	0.003

Random Effects

σ^2	0.080
$\tau_{00\ lsoa11cd}$	0.005
$\tau_{11\ lsoa11cd.pct\_air\_home}$	406.26
$N_{lsoa11cd}$	6771
Observations	1642557
Marginal R^2 / Conditional R^2	0.561 / 0.586
AIC	2199700.213

log-Likelihood	-264378.666

** p<0.05 ** p<0.01 *** p<0.001*

Figure 7-1 gives the distribution of standardised residuals from the multilevel model regression, with the standardised residuals from the local regression model being spatially and completely randomly distributed. This indicates that the multilevel model regression results are overall more satisfactory.

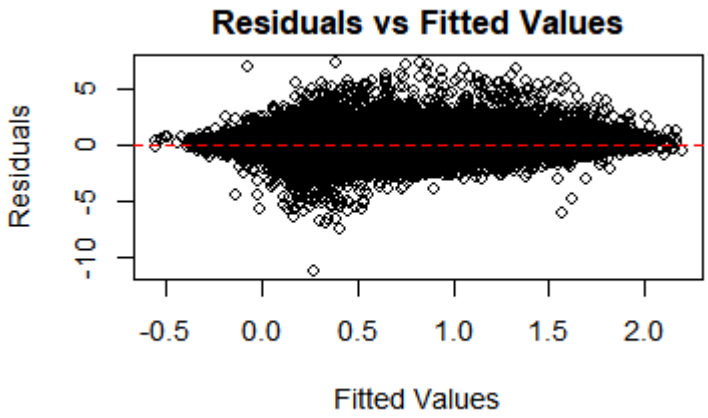


Figure 7-1 The distribution of standardised residuals from the multi-level model for all Airbnb properties.

The table presents various parameter estimates, with the variance of unexplained changes in the model, σ^2, being 0.08. The multilevel model provides a specific variance of 0.005 for the model intercept at level 2, and a specific variance of 406.26 for the model slope term related to the variable pct_air_home. This suggests substantial variability or heterogeneity at this level, with the variation in the rate of house price changes between different neighbourhoods being relatively small, while the impact of Airbnb properties exhibits significant differences between neighbourhoods. The model's Marginal R^2 and Conditional R^2 are 56.1% and 58.6%, respectively, an improvement from the 55.1% of the ordinary linear model. This indicates that the inclusion of fixed and random effects contributes significantly to explaining the variability of the dependent variable, enhancing the model's goodness of fit. The model's AIC statistic has decreased, and the model's log-Likelihood has significantly increased. The likelihood ratio statistic of the two models, -2log(likelihood), is -2*(-304212-(-264379)) = 79666. This likelihood ratio statistic on 2 D.F. is significant at the 0.001 level under the Chi-squared distribution. The significant statistical difference in the AIC and log-Likelihood indicators suggests that the two-level mixed-effects model fits better than the ordinary linear model.

Secondly, the fixed effects parameter estimates from the Table 7-1 show that, at a confidence level of 0.001, the coefficients of the fixed effects intercept and all variable slope terms have passed the statistical significance test. The intercept term indicates that housing transaction prices exhibited a growth trend between 1995 and 2019, with the average price increase reaching $e^{1.991}$=7.32 times. The slope term for pct_air_home suggests that for every percentage point increase in the proportion of Airbnb properties in a neighbourhood, the average house price increases by 16.09% ($e^{\left(\frac{14.918}{100}\right)}$-1=16.088%). This estimate is significantly higher than that of the ordinary linear model.

From the above, the introduction of random effects into the model offers a more nuanced reflection of the hierarchical structure of data. This approach not only enhances the model's fit and explanatory capacity but also facilitates a more robust estimation (Leishman et al., 2013). As a result, the inferences from the multilevel regression analysis are more dependable than those derived from conventional linear regression models, with the added advantage of capturing variations across different levels. The study of house price growth rates in three distinct cities reveals the significant influence of both individual and neighbourhood-level factors (Todd, Musah, & Cheshire, 2021). Furthermore, it can be observed that Airbnb's influence on house price growth rates varies significantly from one neighbourhood to another, demonstrating both neighbourhood effects and spatial differences (Voltes-Dorta & Sánchez-Medina, 2020). This necessitates a more in-depth exploration of the disparities in house price growth and the varying mechanisms of Airbnb's impact across different neighbourhoods. Such an investigation could significantly enhance the understanding of the complex dynamics at play in these urban housing markets.

7.2.1.1 Interpretation of the intercept

To begin with, it is vital to comprehend the initial housing price growth rate of the neighbourhood itself by interpreting the intercept, as it establishes a baseline in the regression model, given the inherent variability in inflation across different neighbourhoods (Tian, Wei, & Li, 2017). Table 7-2 lists the minimum, lower quartile, median, upper quartile and maximum values of the random intercepts and random slopes for the random effects component. The coefficients of the random effects component are obeying a normal distribution, and still some differences in the coefficients in different spatial regions can be found (Chi et al., 2022). Based on the random effects results of the multilevel model, the regression results are geo-visualised to present the spatial distribution and heterogeneity of the starting growth rate of house prices in the neighbourhood itself.

Table 7-2 Distribution of intercepts and random slopes of hybrid multi-level repeat sales model across three cities.

	Region(N)	P0	P25	P50	P75	P100
(Intercept)	Bristol (263)	-0.13	-0.03	0.01	0.05	0.20
	Greater London (4835)	-0.32	-0.02	0.01	0.05	0.26
	Greater Manchester (1673)	-0.34	-0.09	-0.06	-0.02	0.30
pct_air_home	Bristol (263)	-4.12	9.69	14.92	20.84	47.97
	Greater London (4835)	-55.67	9.96	14.92	21.42	80.42
	Greater Manchester (1673)	-104.89	14.92	14.92	14.92	47.36

By adopting the standard deviation classification method, the estimated values of the intercept term in the random effects are divided into 8 levels. This can intuitively reflect the spatial heterogeneity and cluster characteristics of the neighbourhood's own initial housing price growth rate (see Figure 7-2).

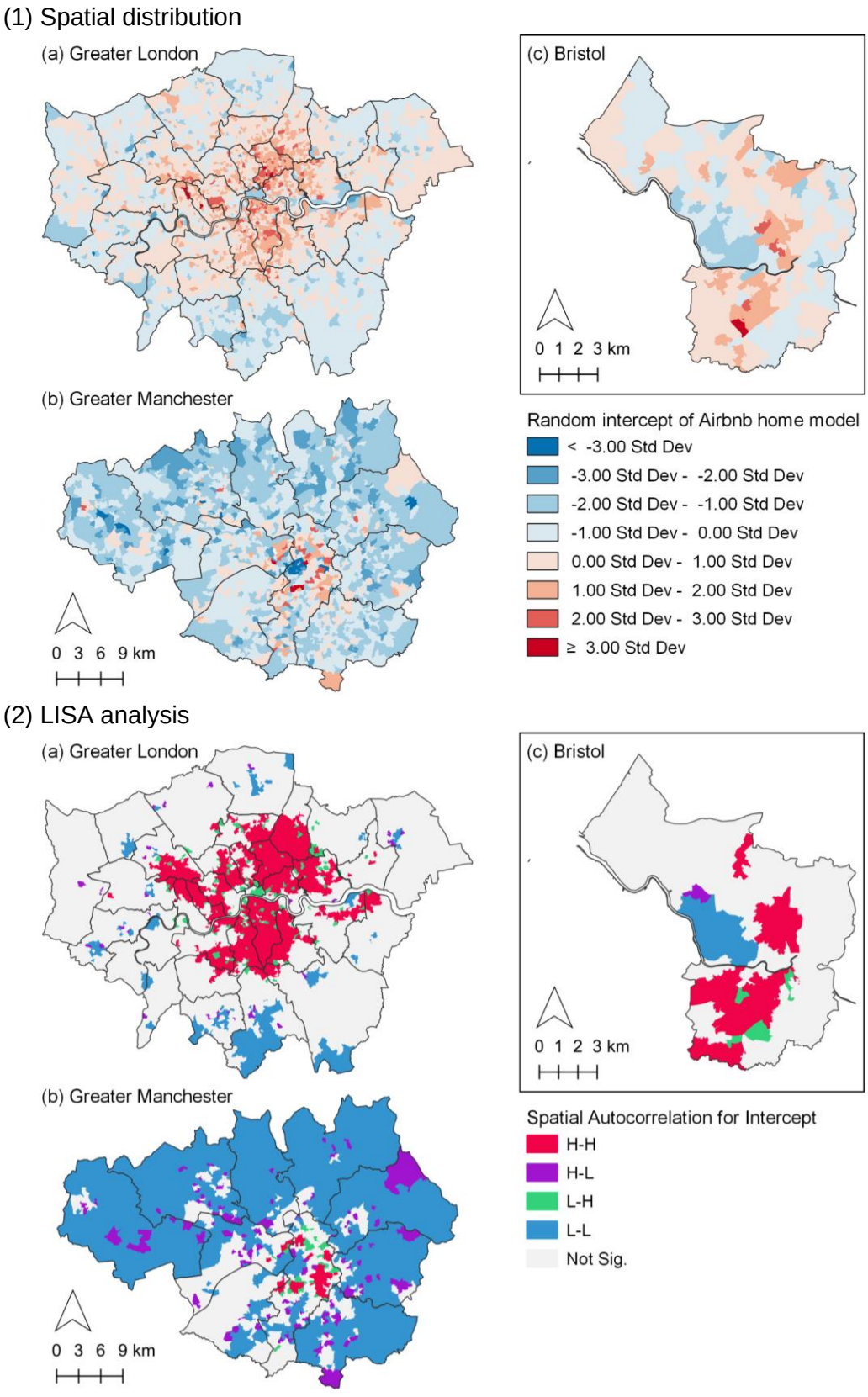


Figure 7-2 Spatial distribution of the random intercept of the all-Airbnb-properties model and its LISA analysis across three cities. (Own elaboration)

1) In the Greater London area, a distinct pattern emerges in the initial growth rates of neighbourhood housing prices, which generally decrease progressively from the city centre towards the periphery. However, the degree of growth also exhibits a clear spatial clustering characteristic. The growth rate of housing prices in a neighbourhood is influenced by its geographical location. Neighbourhoods near the city centre and within inner London display a high-value agglomeration, while those far from the city centre and located on the edge of Greater London experience slower growth in housing prices.

High growth rate clusters are predominantly found in three groupings within Inner London. The first is the strip region extending from Chelsea to Brent, characterised by many high-end residential units and commercial facilities, attracting an abundance of affluent residents and investors (Todd, Musah, & Cheshire, 2021). The second includes Hackney, Waltham Forest, and Newham — a cluster that has been the focus of urban renewal and regeneration efforts in recent years. Benefiting from the Olympics and transportation improvements, this area has seen significant increases in both housing demand and prices (Batten, 2022). The third cluster is located on the south bank of the Thames in the Southwark, Lambeth, and Lewisham areas. This group represents an emerging hub for London's cultural and creative industries, drawing in an extensive population of young people and entrepreneurs. Of note, there are six neighbourhoods where the rate of growth in housing prices exceeds the average by more than three standard deviations. Two of these are located near Kensington in the first cluster, while the remaining four are in Hackney, part of the second cluster. The 131 neighbourhoods where housing prices have grown at rates between two and three standard deviations above the average are mainly distributed within these three clusters. A further 675 neighbourhoods, scattered around Greater London's suburban boroughs, have seen housing price growth rates between one and two standard deviations above the average.

By contrast, low-growth rate clusters are primarily located in Greater London's outer suburban boroughs, such as Sutton and Croydon, as well as on the very edges of the Greater London area. There are two neighbourhoods where housing prices have grown at rates three standard deviations below the average. These are located in the Thamesmead Moorings area, on the south bank of the Thames in the Greenwich borough at London's eastern edge. Historically, this area has had poor public transportation and a lack of properly maintained buildings, leading to it being referred to as a "sinking estate" (Moore, 2020). 14 neighbourhoods, including the low-value cluster in Croydon, the aforementioned Thamesmead area, and west suburban Hillingdon, have seen property prices grow at rates between two and three standard deviations below the average. Finally, the 208 neighbourhoods where housing prices have grown at rates between one and two standard

deviations below the average are primarily found in Greater London's southern low-value cluster and the suburbs of Outer London.

2) In the Greater Manchester area, the initial growth rates of neighbourhood housing prices exhibit a pattern of increasing from the city centre towards the suburbs, followed by a decrease further out. However, high-value areas are confined to a few small regions within Manchester. This suggests that the growth rate of housing prices in neighbourhoods in the city centre is relatively low, while the periphery of the core city experiences a more rapid increase. Yet, in the outer suburban areas, low growth rates dispersed.

High-growth rate clusters are primarily found in three groupings in Manchester. The first is the two areas bordering Old Trafford and Manchester, the second consists of the grouping in East Manchester, including Longsight and Gorton, and the third is the Miles Platting and Newton Heath group in Northeast Manchester. These clusters all offer close proximity or good transport connections to the city centre. Among these areas, seven neighbourhoods experienced a rate of housing price growth exceeding three standard deviations above the average. Five of these are in the Moss Side-area that forms the first cluster – an area historically known for poverty and crime yet has undergone massive urban renewal and community development in recent years (Rahman & Green, 2010), boosting local housing values. Additionally, one such high-growth neighbourhood is near the third cluster, and the last is located in Salford. There are 23 neighbourhoods where housing prices have grown at rates between two and three standard deviations above the average, predominantly distributed within the three clusters on the outskirts of the city centre. Moreover, 61 neighbourhoods dispersed across the three primary clusters and the suburban boroughs of Greater Manchester have witnessed housing price growth rates between one and two standard deviations above the average.

On the other side of the spectrum, low-growth rate areas cover practically all areas of the city centre and the extensive Manchester suburbs. Here, 23 neighbourhoods have housing price growth rates three standard deviations below the average, with over 70% clustered in the city centre's core areas – potentially associated with the suburbanisation of middle-class residential areas in Manchester (Couch & Cocks, 2013). The remaining neighbourhoods are spread out across far-off suburbs, such as Wigan. 142 neighbourhoods with housing price growth rates falling between two and three standard deviations below the average scatter across all boroughs in Greater Manchester. These areas were once prosperous industrial towns that experienced economic decline and societal difficulties in the late 20th century, suffering from the impacts of globalisation and deindustrialization (Lewis, 2016). Only a relatively small number of these neighbourhoods are located within Trafford. Furthermore, 570 neighbourhoods with housing price growth rates between one and two standard deviations below

the average sprawl across 30% of Greater Manchester, signifying that the average growth rate in Greater Manchester is lower than the other two cities.

3) In the Bristol area, the initial growth rates of neighbourhood housing prices generally present a pattern of lower rates in the city centre and higher rates in the periphery, primarily divided into three regions by the River Avon and Temple Way. Spatially, neighbourhoods with high initial growth rates are predominantly concentrated in the eastern and southern regions, while those with low initial growth rates are primarily located in the city centre.

High growth rate clusters are mainly found in two areas: one to the east of Temple Way and the other south of the River Avon. Among these, only one neighbourhood, Inn's Court located in the second cluster, has experienced a housing price growth rate exceeding three standard deviations above the average. There are four neighbourhoods where housing prices have grown between two and three standard deviations above the average. Three of these are in the first cluster's Ashley and Lawrence Hill, which is Bristol's largest immigrant settlement (Fullforth et al., 2020), and the remaining one is in the second cluster's Filwood, which is one of Bristol's primary targets for housing improvement and community development.

Low growth rate clusters cover nearly all areas west of Temple Way in the city centre, including Bristol's oldest and most bustling centres of commerce, culture, and education. Within these neighbourhoods, there are 28 where the rate of housing price growth falls between one and two standard deviations below the average. However, there are no neighbourhoods where growth falls below two standard deviations, which suggests that though housing prices in these areas haven't grown quickly, they also haven't significantly decreased. This might be due to higher existing housing prices, excellent facilities, and a stable real estate market in these areas.

7.2.1.2 All Airbnb properties

This section further explores the impact of Airbnb on the growth rate of neighbourhood housing prices, Table 7-2 lists the minimum, lower quartile, median, upper quartile, and maximum values of the random slope for the random effects of pct_air_home. The coefficients of the random effects section are assumed to obey the normal distribution, but it still can be found that it varies in each city.

The estimated pct_air_home coefficient in the fixed effect is added to the corresponding random effect coefficient to get the total effect for each neighbourhood, and then classified into 10 levels using standard deviation classification method, which can intuitively reflect the spatial heterogeneity characteristics of Airbnb ratio on neighbourhood housing price growth rate. From its spatial distribution, there are some spatial differences in the degree of influence so it requires further delving into its clustering characteristics (Figure 7-3).

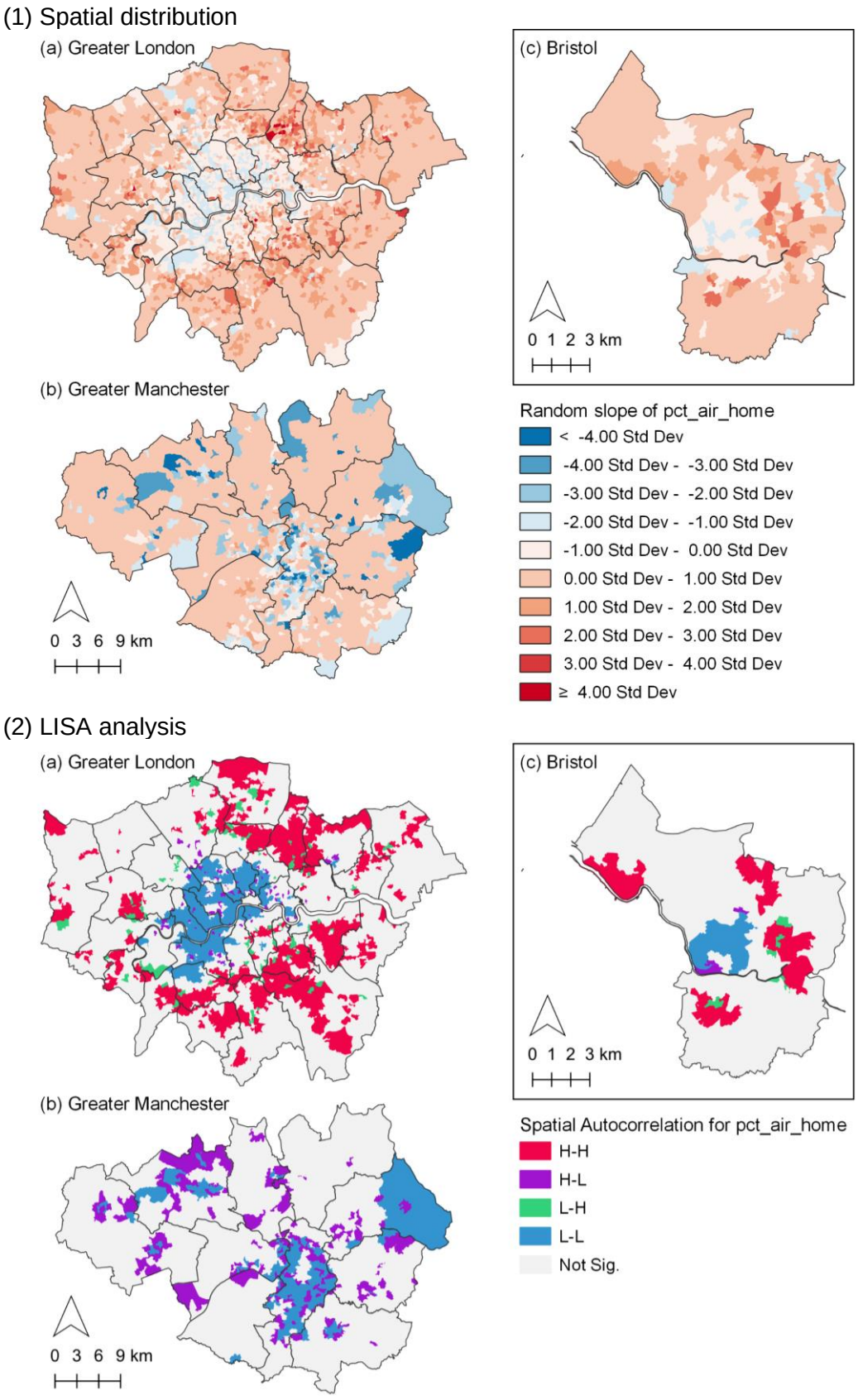


Figure 7-3 Spatial distribution of the random slopes of pct_air_home and its LISA analysis across three cities. (Own elaboration)

1) In the Greater London area, the impact of Airbnb on neighbourhood housing prices generally exhibits a spatial pattern of lower influence in the city centre and higher in the periphery. This suggests that Airbnb's impact is less pronounced in central neighbourhoods compared to suburban ones, reflecting an uneven distribution of Airbnb's influence within the urban structure. This spatial pattern is further characterised by the formation of H-H and L-L clusters, demarcating three distinct regions in London: the Central, South, and North.

The areas with a high impact are mainly divided into two clusters in Outer London. One is the area formed by Haringey, Waltham Forest and Redbridge in the north-eastern suburbs of Greater London, which is close to the Olympic Park and other tourist attractions, attracting many tourists and business travellers to choose Airbnb as their accommodation option, but the housing supply has been in long-term deficit, and using houses as Airbnb to obtain extra income has aggravated the local housing crisis (Snelling, Colebrook, & Murphy, 2016). The other is the area covering from Kingston upon Thames to Greenwich and from Lewisham to Bromley in the southern suburbs of Greater London, which may be because these areas, although located in the suburbs, have a diverse culture and young population, and have advantages in terms of living comfort and housing cost, making these areas' houses easy to be used as Airbnb (Paccoud & Mace, 2018), while the housing supply is relatively stable, thereby pushing up the house prices; the rest are some small neighbourhood clusters at the east and west ends of Greater London, which also have characteristics such as relatively diverse population, convenient transport connections, and abundant green space. Among them, there are 8 neighbourhoods where the impact of Airbnb's penetration ratio on house prices exceeds the average by 4 standard deviations, 5 of which are concentrated in the Waltham Forest borough of the first cluster. There are 205 neighbourhoods where the impact of Airbnb's penetration ratio on house prices exceeds the average by 2-4 standard deviations, most of which form the first cluster in the north-east of Greater London, followed by the second cluster. There are 2,951 neighbourhoods where the impact of Airbnb's penetration ratio on house prices exceeds the average by 0-2 standard deviations, which has covered more than 60% of the neighbourhoods in Greater London, indicating that Airbnb's impact in Greater London is higher than the other two cities. Airbnb has an overall positive effect on house prices in more than 67.76% of the neighbourhoods in Greater London and has a potential slight positive effect on 27.24% of the neighbourhoods, but this effect varies significantly between the central city and the suburbs. Combined with the neighbourhoods' own house price growth rate, it can be found that the house prices in the central city are relatively high, and the house prices are more derived from the growth brought by the neighbourhoods' own improvement, and the premium brought by Airbnb is relatively small.

The areas with a low impact are mainly the area formed by Inner London to the south-west direction to Merton, which occupies about 1/4 of the neighbourhoods in Greater London. The residents of this area are mainly middle- and high-income classes, and these areas have high housing values. They are more inclined to own their properties, rather than rent them to Airbnb (Kemp, 2015). Airbnb's invasion may affect the neighbourhood's atmosphere and have a negative impact on house prices. Among them, there is only one neighbourhood where the impact of Airbnb's penetration ratio on house prices exceeds the average by 4 standard deviations, located near Ilford Station in Redbridge, where the noisy environment near the train station affects the demand for Airbnb. There are 7 neighbourhoods where the impact of Airbnb's penetration ratio on house prices is below the average by 2-4 standard deviations. There are 410 neighbourhoods where the impact of Airbnb's penetration ratio on house prices is below the average by 1-2 standard deviations, which are mainly distributed in the low-value cluster to the west of the city centre, where Airbnb's atmosphere causes a slight devaluation of the houses in the neighbourhood. In fact, Airbnb has a negative impact on house prices in only a very small proportion of neighbourhoods in Greater London.

2) In Greater Manchester, the impact of Airbnb on local housing prices similarly exhibits a spatial pattern of lower influence in the central urban areas and a slightly higher impact in the suburban zones. This pattern reflects the agglomeration of Airbnb within the urban structure and urban-rural disparities (Yates et al., 2021), suggesting a differential effect of Airbnb across the city's landscape. This spatial pattern is further characterised by the formation of a hollow L-L cluster which predominantly cover Manchester city, and H-L clusters located in outer suburbs.

The areas where Airbnb has a high impact are very rare, while the areas where Airbnb has a low impact are more widespread. This shows that Airbnb's impact on house prices is relatively low in Greater Manchester, and only has a high premium effect on house prices in a few neighbourhood clusters. Among them, there are 2 neighbourhoods where the impact of Airbnb's penetration ratio on house prices exceeds the average by 2-3 standard deviations, both located in the suburban areas of Manchester. There are 18 neighbourhoods where the impact of Airbnb's penetration ratio on house prices exceeds the average by 1-2 standard deviations, which are mainly distributed in the two administrative districts of Salford and Trafford. However, for most of the areas in Greater Manchester, the impact of Airbnb's penetration ratio on house prices is relatively low. In fact, there are more than 1,270 neighbourhoods (accounting for more than 76% of the neighbourhoods in Greater London) where the impact of Airbnb's penetration ratio on house prices exceeds the average by 0-1 standard deviations. This means that in most of the areas in Greater Manchester, Airbnb only has a slight positive effect on house prices. Airbnb's overall positive effect on house prices in Greater Manchester is relatively

weak compared to Greater London and combined with the neighbourhoods' own house price growth rate in Manchester, it can be found that the house price growth and the premium brought by Airbnb are both slow in the central city.

The low-impact clusters consist of two large areas from Manchester city centre to the south of Wythenshawe and Oldham, and several small clusters in Bolton and Stockport, which account for about 18.7% of the neighbourhoods in Greater Manchester. The low-value areas in Manchester city centre, especially its core area, have been heavily infiltrated by Airbnb (Simcock, 2017), which has occupied the supply of housing stock, but has had a negative impact on housing prices. Airbnb's negative impact is even greater in some suburban areas, where Airbnb's presence may also cause some potential home buyers to become renters, further depressing the transaction prices of housing. It can be seen that the invasion may have seriously affected the normal housing prices of Manchester neighbourhoods. Among them, 37 neighbourhoods have Airbnb penetration rates that are below the average by 4 standard deviations, either located in the low-value areas near the outskirts of Manchester city centre, or in the low-value clusters near the centre of Bolton or Wigan, which lack rich tourism or business facilities to attract outsiders for short-term stays. There are also 110 neighbourhoods where Airbnb's impact on housing transaction prices is below the average by 2-4 standard deviations. These neighbourhoods are mainly distributed in the two large areas and the low-value clusters. Although these neighbourhoods have low Airbnb penetration rates, their negative impact on housing transaction prices has caused the houses in these neighbourhoods to depreciate slightly. Airbnb has had a negative impact on housing transaction prices in about 16.7% of the neighbourhoods in Greater Manchester. This shows that although Airbnb can bring some economic activity, its impact on the housing market is not always positive.

3) In Bristol, the influence of Airbnb on local housing prices manifests in a similar spatial pattern, with a less pronounced impact within a 2km radius of the city centre and a slightly more substantial effect in the outer city suburbs. This pattern suggests a differential impact of Airbnb across the urban landscape, characterised by the segmentation of areas into high premium clusters in neighbourhoods with a low proportion of Airbnb listings, and low premium clusters in areas with a high proportion of Airbnb listings. This uneven distribution of Airbnb's influence within the urban structure is indicative of the platform's varying penetration across different neighbourhoods.

The notable effects of Airbnb on neighbourhood housing price premiums are primarily clustered in four groups in Bristol. Firstly, it is observed near Bristol Port located in Avonmouth. Secondly, it can be spotted in Ashton Vale, located at the very south-western edge of the city. The remaining two clusters are located in the outer east, specifically Horfield and St. George West. Even though these areas are not centrally located, they exhibit potential owing to their excellent transport

connections and convenient facilities (Voltes-Dorta & Sánchez-Medina, 2020). Considering the overall influence of Airbnb, only nine neighbourhoods in Bristol display a housing transaction price premium exceeding 2-3 standard deviations above the average. These are primarily located near the high-value clusters in the southern and eastern areas. Furthermore, 27 neighbourhoods exhibit Airbnb effects that are between 1-2 standard deviations above the average. Predominantly found in the eastern and northern areas, these neighbourhoods demonstrate prices that exceed the average, both in terms of their inherent growth rate and the premium driven by Airbnb. This reflects the attraction these neighbourhoods hold for visitors, causing supply to fail to meet the demand for housing.

Areas with a low premium rate cover almost all regions radiating 2.5km northwest from the city centre. Although these territories are wealthier parts of Bristol, the invasion of Airbnb seems to have had a precarious influence. Seventeen of these neighbourhoods have total housing transaction price premiums below 1-2 standard deviations of the average, induced by Airbnb. Still, none of them fell below 2 standard deviations, suggesting that Airbnb has only caused minor negative effects on housing prices in a relatively small proportion of neighbourhoods. These regions are characterised by residents with higher socioeconomic status, exhibiting greater selectivity (Chatterton, 2010). They may place a higher value on the stability of their communities, rather than welcoming an influx of transient rental properties that could alter the communal culture. Overall, the negative effects brought by Airbnb are restricted. There have been no instances of significant plunges in housing prices. This can be attributed to the robust social and economic foundations of these areas and the stability of the real estate market therein.

7.2.1.3 Summary for the initial growth rate and All types of Airbnb properties

In summary, the neighbourhoods' own housing price growth rates in the three cities show a significant spatial differentiation, with obvious high and low growth rate clusters in different areas. High growth rate clusters are mostly located near the city centre or in suburban areas with convenient transportation, which are more positively affected by urban renewal, infrastructure construction, industrial upgrading, etc (Rae, 2013). Low growth rate clusters are mostly distributed in the old areas of the city centre or in the outer suburbs, where investment is not prosperous, and development is stable. These spatial distribution characteristics reflect the changes in urban structure and social structure and are also related to the development strategies and policies of each city. The micro-mechanisms of industrial transformation, population migration, community revival, etc. in different cities have superimposed effects (Cardoso, 2023), forming the unique growth patterns of each neighbourhood.

Airbnb's impact on neighbourhood housing prices in the three cities showed different patterns due to the differences in city size and location, but also some common features. The influence of Airbnb on neighbourhood housing prices in the three cities showed a spatial distribution pattern of low in centre and high in suburbs. This is mainly because the housing prices in the central urban areas are relatively high, and the premium space brought by Airbnb is limited (Mikulić et al., 2021). While the housing supply in the suburbs is relatively stable, when homeowners rent out the entire house for a short period of time, they deprive potential buyers of the opportunity to buy these houses, which creates a scarcity effect, resulting in a situation of supply and demand imbalance, pushing up the demand and price of the remaining houses on the market, making Airbnb's impact on suburban neighbourhoods relatively large. In addition, the housing costs in the suburbs are moderate, attracting investment as Airbnb rentals. Airbnb provides an opportunity to use vacant houses to increase income and attract outsiders, thereby stimulating the activity of the suburban housing market, which may potentially increase the attractiveness and value of the area to tourists and visitors. In the long run, this may further increase the house prices.

A correlation analysis between the intercept and slope was conducted (Figure 7-4). A positive correlation coefficient of 0.03 suggests that neighbourhoods with a high intercept (initial growth rate of housing prices) tend to have a higher slope (premium rate generated by Airbnb in the neighbourhood). For instance, from this graph, it is straightforward to identify which neighbourhoods have an initial growth rate and Airbnb-induced premium rate higher than the average. Neighbourhoods in the top right quadrant, with an intercept greater than 0 and pct_air_home greater than 0, are such neighbourhoods.

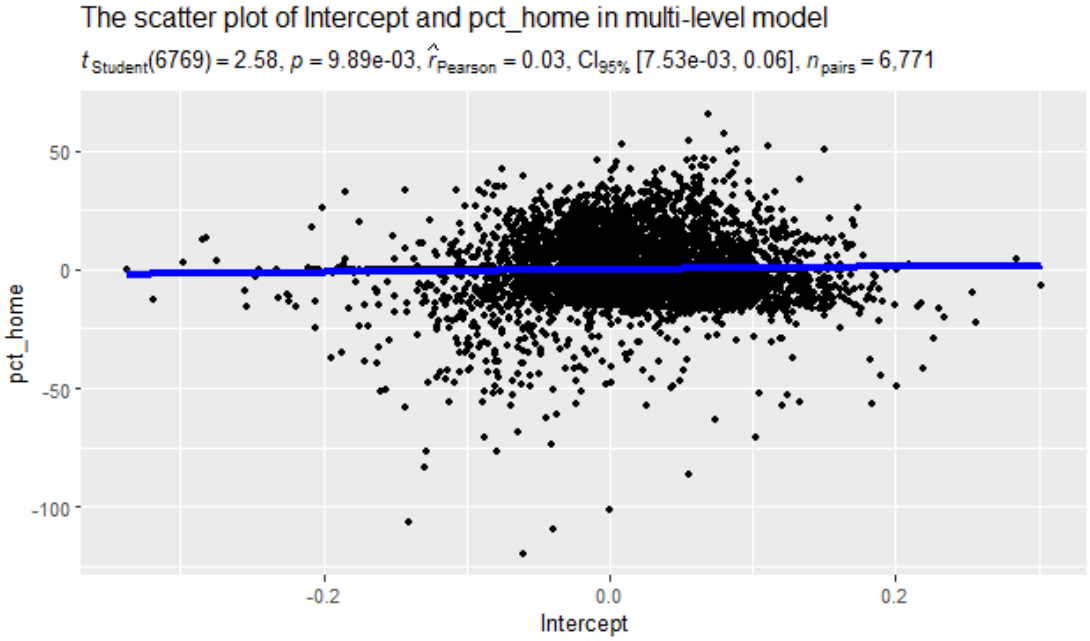


Figure 7-4 Correlation analysis of intercept and slope for multi-level model.

Among the three cities under scrutiny, London sees the most substantial elevation in housing prices due to Airbnb, with over 95% of neighbourhoods experiencing varying degrees of positive impact. Manchester follows suit, albeit with Airbnb's influence being relatively minor across most neighbourhoods. Discrete blocks exhibiting negative effects are primarily located in the city centre. Bristol experiences the least impact, with only certain suburban areas showing a pronounced positive effect. Conversely, mild negative effects can be observed in the city centre.

On the whole, enhancements in the local environment of a neighbourhood often intimate that Airbnb-induced price premiums will also be higher (Xu et al., 2020). High premium areas frequently appear in suburban locales that boast excellent transport links, comprehensive facilities, high development potential, and relatively large influxes of non-residents. Regions experiencing negative effects are predominantly central city districts rich in community culture and characterised by residents exhibiting strong selectivity.

The impact of Airbnb on housing prices in various city districts correlates closely with the inherent conditions of the district itself and the development of the real estate market (Bao & Shah, 2020; Tejedor Galindo, 2020). This highlights the significance of contextual factors when considering Airbnb's potential impacts, further emphasising the embeddedness of these platforms within wider urban and societal structures.

7.2.2 Neighbourhood heterogeneity in the implied impact of different types of Airbnb on house prices

Further empirical analysis of the impact on housing transaction prices for different types of Airbnb properties in the three cities was conducted. The model converged after numerous iterations, and the estimation results of the multilevel effects regression model are shown in Table 7-3:

Table 7-3 Hybrid repeat sales multi-level model for different types of Airbnb properties.

	Different types	
Predictors	*B*	*SE*
(Intercept)	1.866 ***	0.047
pct_air_house	8.903 ***	0.717
pct_air_flat	10.071 ***	0.354
log(datebtwn)	-0.051 ***	0.001

dwe_modage	-0.001 ***	0.000
y1996	0.032 ***	0.001
y1997	0.154 ***	0.001
y1998	0.276 ***	0.001
y1999	0.401 ***	0.001
y2000	0.577 ***	0.001
y2001	0.688 ***	0.001
y2002	0.842 ***	0.001
y2003	0.983 ***	0.001
y2004	1.092 ***	0.002
y2005	1.142 ***	0.002
y2006	1.206 ***	0.002
y2007	1.325 ***	0.002
y2008	1.328 ***	0.002
y2009	1.231 ***	0.002
y2010	1.303 ***	0.002
y2011	1.316 ***	0.002
y2012	1.346 ***	0.002
y2013	1.399 ***	0.002
y2014	1.512 ***	0.002
y2015	1.577 ***	0.003
y2016	1.644 ***	0.003
y2017	1.665 ***	0.003
y2018	1.666 ***	0.003
y2019	1.661 ***	0.003

Random Effects

σ^2	0.079
$\tau_{00\ lsoa11cd}$	0.004

$\tau_{11\ lsoa11cd.pct\_air\_house}$	727.735
$\tau_{11\ lsoa11cd.pct\_air\_flat}$	136.625
$N_{lsoa11cd}$	6771
Observations	1642557
Marginal R^2 / Conditional R^2	0.582 / 0.602
AIC	2187121.656
log-Likelihood	-258087.388

** p<0.05 ** p<0.01 *** p<0.001*

Figure 7-5 gives the distribution of standardised residuals from the multilevel model regression, with the standardised residuals from the local regression model being spatially and completely randomly distributed. This indicates that the multilevel model regression results are overall more satisfactory.

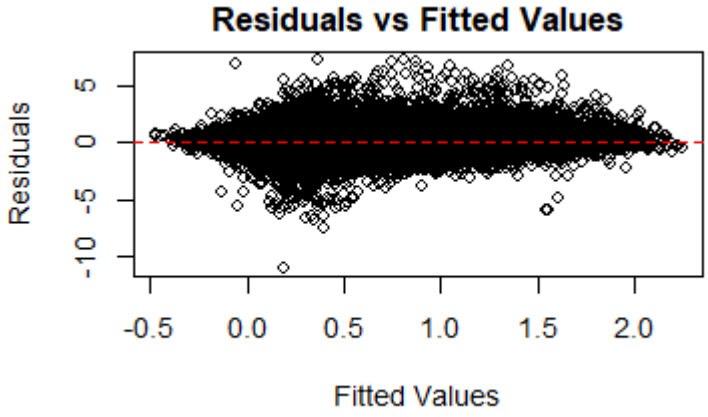


Figure 7-5 The distribution of standardised residuals from the multi-level model for different types of Airbnb properties.

The variance of the unexplained variance in the model, σ^2, is 0.08, as estimated by the parameters given in the Table 7-3. The multi-level model gives a specific variance of 0.004 for the model intercept at level two, a specific variance of 727.735 for the model slope term related to the variable pct_air_house, and a specific variance of 136.625 for the model slope term related to the variable pct_air_flat. This means that there is a large variability or heterogeneity at this level, and the variation in the neighbourhoods' own housing price growth rates is relatively small, while the effect of Airbnb house properties is huge among different neighbourhoods, and the effect of Airbnb flat properties is also considerable among different neighbourhoods. The Marginal R^2 and Conditional R^2 of the model are

58.2% and 60.2%, respectively, which are improved compared to the ordinary linear model's 55.1%, indicating that adding fixed effects and random effects, and splitting the Airbnb proportion into different types of variables, have important contributions to explaining the variation of the dependent variable, and improve the goodness of fit of the model. Compared with the ordinary linear model, the AIC statistic of the model has decreased, and the log-Likelihood of the model has increased significantly. The log-Likelihood ratio of the two models is -2log(likelihood) = -2*(-301103-(-258087)) = 86032, which is significant on 2 D.F. at the 0.001 level of the Chi-squared distribution. The difference between the two indicators of AIC and log-Likelihood is statistically significant, indicating that the two-level regression mixed-effects model fits better than the ordinary linear model.

Secondly, the fixed-effects parameter estimation results in the table show that at the confidence level of 0.001, the coefficients of the intercept term and all variable slope terms on the fixed effects have passed the statistical significance test. The slope term of pct_air_house indicates that for every 1% increase in the proportion of Airbnb occupied housing in the neighbourhood, the average house price increases by 9.3% ($e^{\left(\frac{8.903}{100}\right)}$-1=9.311%), and the slope term of pct_air_flat indicates that for every percentage point increase in the proportion of Airbnb occupied housing in the neighbourhood, the average house price increases by 10.6% ($e^{\left(\frac{10.071}{100}\right)}$-1=10.596%). These estimates are much higher than those of the ordinary linear model.

Table 7-4 lists the minimum, lower quartile, median, upper quartile, and maximum values of the random slopes of pct_air_house and pct_air_flat in the random-effects part. The coefficients of the random-effects part are basically normally distributed, but it can still be found that the impact coefficients of house and flat type Airbnb vary greatly among different neighbourhoods. Based on the random-effects results of the multi-level model, this allows for spatial visualisation of the regression results to intuitively show the spatial distribution and heterogeneity of Airbnb's impact on housing price growth.

Table 7-4 Random slope distribution of multi-level hybrid repeat sales model for different types of Airbnb in three cities.

	Region(N)	P0	P25	P50	P75	P100
pct_air_house	Bristol (263)	-18.58	2.32	8.90	8.90	75.59
	Greater London (4835)	-21.49	7.33	8.90	8.90	85.33

	Greater Manchester (1673)	-132.75	8.90	8.90	8.90	47.25
pct_air_flat	Bristol (263)	-17.41	3.49	10.07	10.07	76.75
	Greater London (4835)	-20.32	8.49	10.07	10.07	86.50
	Greater Manchester (1673)	-131.58	10.07	10.07	10.07	48.42

7.2.2.1 Heterogeneous impact of house-type Airbnb properties

To further comprehend the heterogeneous impact of house-type Airbnb on the growth rate of neighbourhood housing prices, the total effect for each neighbourhood is obtained by adding the estimated value of the coefficient of pct_air_house in the fixed effects to the corresponding random effects coefficient. Subsequently, the standard deviation classification method is used to divide these into 10 levels, which can intuitively reflect the between-neighbourhood heterogeneous characteristics of the proportion of house-type Airbnb on the growth rate of neighbourhood housing prices (see Figure 7-6).

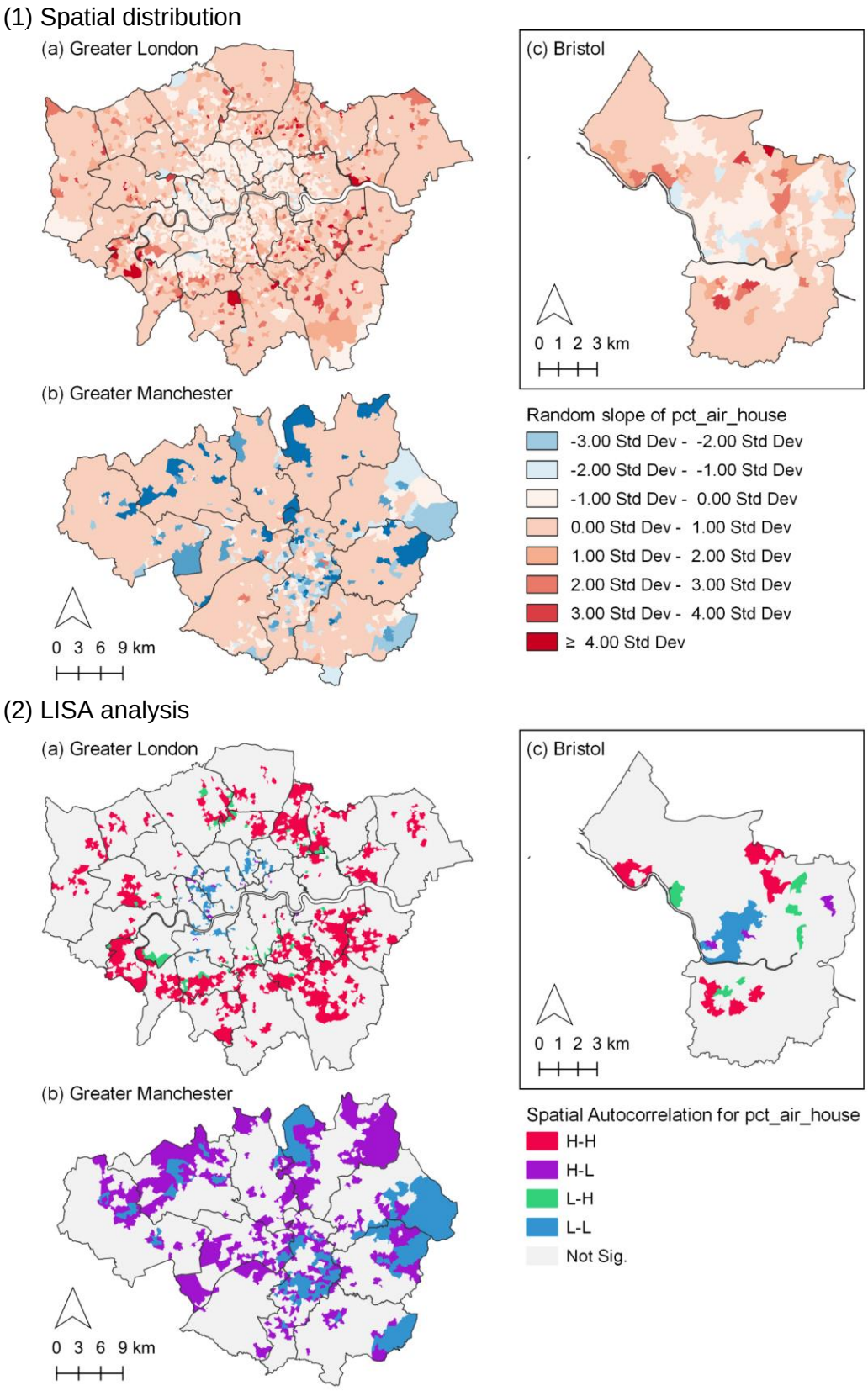


Figure 7-6 Spatial distribution of the random slopes of pct_air_house and its LISA analysis across three cities. (Own elaboration)

1) In the Greater London area, the influence of house-type Airbnb listings on neighbourhood housing prices exhibits a spatial distribution trend characterised by central decline, banded radiation, and subdued suburbanisation features. This trend also reveals a relatively lower impact in the city centre and a higher impact in the suburbs, albeit with a slightly reduced clustering effect. This finding reflects the agglomerative influence of house-type Airbnb listings on neighbourhood housing prices.

The clusters where Airbnb has a significant impact on neighbourhood housing prices are primarily located in two groups of outer London. The first cluster, like all Airbnb, is the sector in the north-eastern suburbs of Greater London. This locale has a large number of immigrants and ethnic minority residents, attracting many family outsiders to choose entire house Airbnb as their accommodation (Snelling, Colebrook, & Murphy, 2016). However, it is noteworthy that the supply of house-type properties in this region exhibits a high degree of inelasticity, so the extensive utilisation of entire houses for Airbnb purposes has exerted a pronounced impact on this sub-market. The second sector encompasses extensive areas in the southern suburbs of Greater London. Although these areas are located in the suburbs, they have varied ethnic compositions and a youthful demographic profile, coupled with advantages regarding residential comfort and cost-effectiveness. It is this combination of factors that renders house-type property prices in these localities susceptible to upward pressures emanating from the presence of Airbnb. The rest are small neighbourhood groups at the east and west ends of Greater London, which also have relatively diverse populations and a prevalence of house rentals. Among these clusters, 33 neighbourhoods register an impact of house-type Airbnb penetration on housing transaction prices exceeding the average by a magnitude of 4 standard deviations. These neighbourhoods are predominantly scattered in the suburbs around. An additional 225 neighbourhoods witness the influence of house-type Airbnb penetration on housing transaction prices falling between 2 and 4 standard deviations above the average. Most of these neighbourhoods are scattered in the north-eastern group and the southern sector. There are 3,235 neighbourhoods where the impact of the penetration of house-type Airbnb on housing transaction prices is within the range of 0-2 standard deviations above the average. This extensive coverage encompasses more than 2/3 of Greater London's neighbourhoods, indicating a slight increase in housing prices for most neighbourhoods in Greater London. The spatial clustering pattern of Airbnb's impact is mainly determined by house-type properties, but this does not necessarily equate to a high magnitude of impact on housing prices resulting from house-type home sharing activities.

The clusters with low or negative impacts are concentrated within a sector spanning from Central London towards the southwestern expanse including Wandsworth and Merton, accounting for about 1/5 of the number of

neighbourhoods in Greater London. Positioned within the high-density metropolitan core of the inner city, these neighbourhoods demonstrate high property values and are primarily inhabited by middle and high-income class homeowners, who display a tendency towards homeownership rather than renting them out on Airbnb. Even in circumstances where Airbnb has infiltrated these areas, it has occasionally fostered a disharmonious environment, culminating in a detrimental impact on housing prices. Within these neighbourhoods, there is only one neighbourhood where the impact of Airbnb's penetration ratio on housing transaction prices is less than 2 standard deviations below the average. This unique neighbourhood is located in Woolwich Riverside, Greenwich, where the proportion of entire house Airbnb slightly surpasses that of its adjacent areas. Furthermore, there are 60 neighbourhoods where the impact of Airbnb's penetration ratio on housing transaction prices is between 1-2 standard deviations below the average. They are primarily distributed in the city centre and to the west, where house-type Airbnb properties are prevalent. The conspicuous presence of Airbnb activity in these areas contributes to a perceived degradation in the overall neighbourhood atmosphere, thereby exerting a suppressive impact on property values (Cheung & Yiu, 2022). According to the statistical summary, it becomes evident that house-type Airbnb listings yielded a detrimental influence on housing transaction prices in approximately 10.32% of Greater London's neighbourhoods. This underscores the nuanced neighbourhood heterogeneity characterising the relationship between house-type Airbnb utilisation and local housing markets within Greater London.

2) In Greater Manchester, the impact of house-type Airbnb on neighbourhood housing prices exhibits a spatial pattern of lower prices in the central city areas outside the core and slightly higher prices in the suburbs. This phenomenon reflects Airbnb's market positioning within the urban structure, as well as revealing the socio-economic characteristics of the Greater Manchester area.

The degree of influence of house-type Airbnb on neighbourhood housing prices demonstrates that areas with high-high (H-H) clustering are rare, while neighbourhoods with high-low (H-L) clustering are more widespread. This suggests that the influence of house-type Airbnb on housing transaction prices in Greater Manchester is relatively low and dispersed, with only a few neighbourhood clusters generating a high premium on housing prices. In particular, 9 neighbourhoods have been identified where the penetration of Airbnb exceeds the average by 1-3 standard deviations, leading to a discernible impact on housing transaction prices. These neighbourhoods are primarily situated in the comfortable suburban areas within the administrative districts of Manchester, Salford, and Trafford. However, for the vast majority of areas in Greater Manchester, the penetration of house-type Airbnb in neighbourhoods has a relatively minimal impact on housing transaction prices. In fact, over 1,394 neighbourhoods, accounting for more than 83% of

neighbourhoods in Greater Manchester, demonstrate an impact of Airbnb's neighbourhood penetration on housing transaction prices that hovers between 0-1 standard deviations above the average. This implies that in most areas of Greater Manchester, house-type Airbnb only has a marginal positive effect on housing prices. This limited lifting impact of house-type Airbnb in Greater Manchester stands in stark contrast to the universal price-inflation witnessed in Greater London.

Areas of low or negative impact have formed around the peripheral areas of Manchester city centre and a few small clusters in Oldham, Bolton, and Stockport, collectively accounting for approximately 47% of the neighbourhoods in Greater Manchester. The low housing value areas on the periphery of Manchester city centre, despite being heavily penetrated by Airbnb, have experienced a negative impact on housing prices. The presence of Airbnb in some suburban areas has an even greater negative impact on house prices, potentially causing some prospective homebuyers to opt for tenancy instead, thereby further suppressing housing transaction prices. This suggests that the intrusion of Airbnb may have severely affected normal housing prices in Manchester neighbourhoods. Among these, there are 53 neighbourhoods where the impact of Airbnb's penetration on housing transaction prices is below the average by 4 standard deviations. These are mostly located in L-L clusters on the periphery of Manchester city centre and suburbs of various boroughs, areas lacking in rich tourism or business facilities to attract short-term foreign residents. Additionally, there are 87 neighbourhoods where the impact of Airbnb on housing transaction prices falls between 2-4 standard deviations below the average. These neighbourhoods are primarily located within various low-value clusters. Despite the relatively low penetration of Airbnb in these neighbourhoods, it has led to a decrease in neighbourhood stability, resulting in a slight depreciation of housing within these neighbourhoods. The misuse of house-type properties as Airbnb has had a negative impact on housing transaction prices in approximately 13% of neighbourhoods in Greater Manchester. This suggests that house-type Airbnb's role in driving up housing prices in Greater Manchester is relatively weak, but the commercialisation of Airbnb may affect housing prices in some neighbourhoods.

3) In Bristol, the impact of house-type Airbnb on neighbourhood housing prices also shows a spatial pattern of slightly lower within a 2km range of the city centre and slightly higher in some neighbourhoods in the outer city suburbs. Spatially, house-type Airbnb seems to have exacerbated the differentiation of housing price levels in different areas of Bristol, resulting in significant sectoral divisions.

The clusters with a high premium rate of house-type Airbnb on neighbourhood housing prices mainly have four groups. The first is located near the River Avon in Shirehampton on the northwestern edge of the city. The second is a few neighbourhoods to the south of the river Avon, and the remaining two are Horfield

and Easton in the outer east. Although these sectors are not located in the city centre, the environment is relatively more open and inclusive (Bristol City Council, 2018). Notably, 4 neighbourhoods are identified where the premium rate of house-type Airbnb properties surpasses the average by 3 standard deviations These neighbourhoods are strategically positioned proximate to the high-value clusters in the southern and northeastern regions. There are 20 neighbourhoods where the premium rate of house-type Airbnb on Bristol neighbourhood housing transaction prices exceeds the average by 1-3 standard deviations, basically located near the four H-H clusters. Although these neighbourhoods have relatively abundant housing resources, they have attracted many visitors, and houses being used as Airbnb or even being occupied for a long time have led to a shortage of neighbourhood housing supply, thus raising neighbourhood housing prices.

The L-L clusters cover most neighbourhoods radiating 2.5km northwest from the city centre. This is a middle class area of Bristol with a large number of international students. These characteristics determine that house-type Airbnb has a limited impact on local housing prices. There are 12 neighbourhoods where the premium rate of house-type Airbnb on neighbourhood housing transaction prices is 1-2 standard deviations below the average, but no neighbourhood has substantial depreciation rate below the average by 2 standard deviations, indicating that Airbnb only exerts a slight negative impact on housing prices within a limited proportion of neighbourhoods. The socio-economic status of residents in these areas is higher who prefer the stability of the neighbourhoods, and the number of houses rented to Airbnb by landlords is relatively small. In addition, there are more international students, who may have less demand for short-term rentals of house type. In brief, the negative externalities of house-type Airbnb on the local community are limited and there has been no significant suppression in housing prices, which is related to the better socio-economic foundation and stable real estate market in these areas of Bristol.

7.2.2.2 Heterogeneous impact of flat-type Airbnb properties

To gain a deeper understanding of the heterogeneous impact of flat-type Airbnb on the growth rate of neighbourhood housing prices, the total effect for each neighbourhood is calculated by summing the estimated value of the pct_air_flat coefficient in the fixed effects with the corresponding coefficient in the random effects. Following this, the standard deviation classification method segregates them into 14 distinct levels. This approach offers an intuitive representation of the between-neighbourhood heterogeneity in how the proportion of flat-type Airbnb influences the growth rate of neighbourhood housing prices (as depicted in the Figure 7-7).

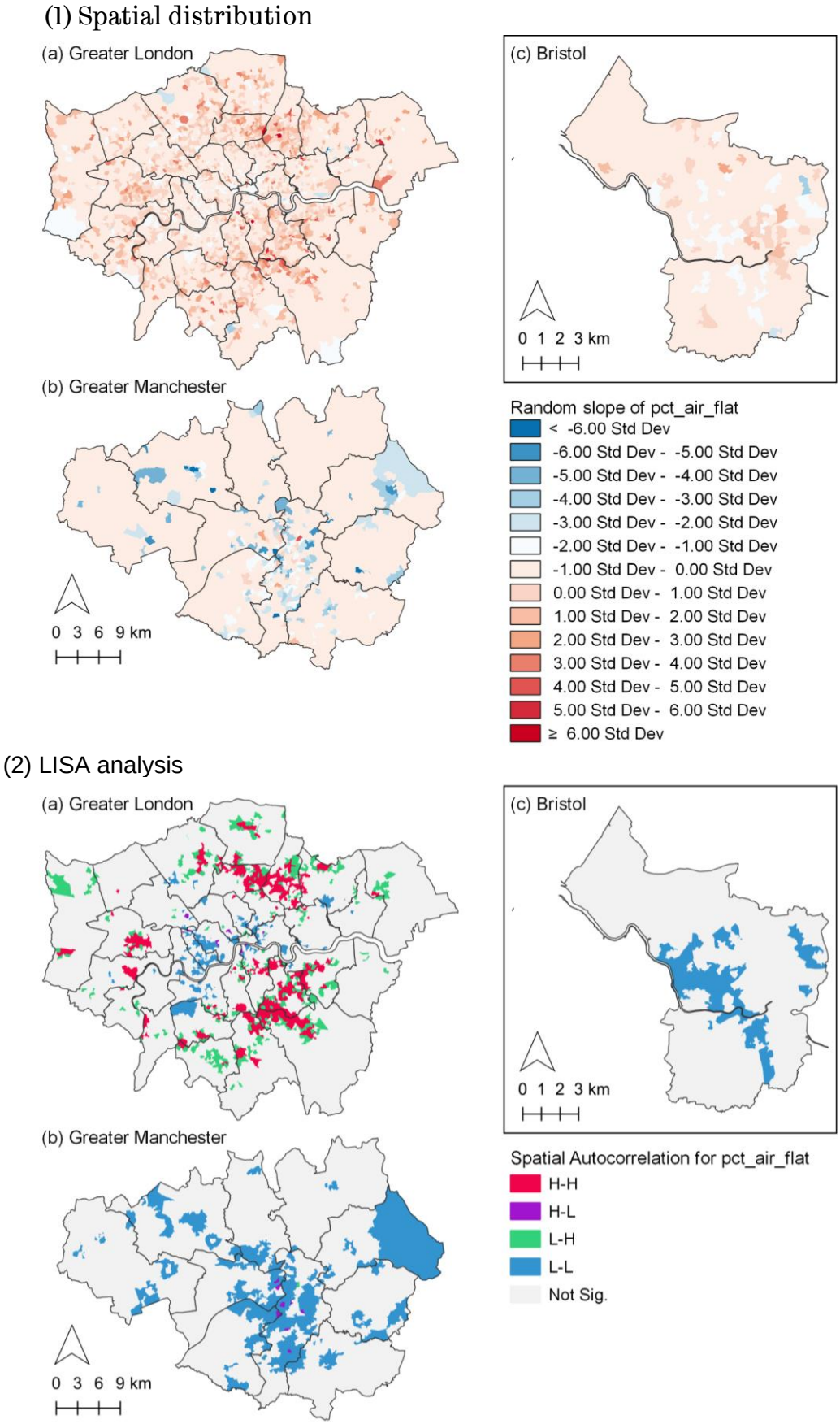


Figure 7-7 Spatial distribution of the random slopes of pct_air_flat and its LISA analysis across three cities. (Own elaboration)

1) In the Greater London area, the impact of flat-type Airbnb listings on neighbourhood housing prices exhibits a distinct banded distribution. This trend is also characterised by a strong clustering effect, with subdued impacts in the city centre, heightened impacts in the suburbs and rare occurrences of negative impacts. It reflects an agglomerative influence of flat-type Airbnb saturation on neighbourhood housing prices in polycentric urban form and propagates gentrification tendencies in certain neighbourhoods.

Primarily, two main sectors in the outer regions of London are home to clusters where flat-type Airbnb notably influences the housing prices in local neighbourhoods, where there is a very limited supply of flat properties which has a significant impact on house prices in this sub-market. The second sector is centred around Lewisham, areas with advantages in terms of residential comfort and cost-effectiveness, but which are susceptible to upward pressure on housing due to the presence of flat-type Airbnb listings. The rest are small neighbourhood groups in Ealing in the west of Greater London. Among these clusters, 30 neighbourhoods register an impact of flat-type Airbnb penetration on housing transaction prices exceeding the average by a magnitude of 4 standard deviations, which are predominantly scattered around the southern and eastern suburbs. There are 1,036 neighbourhoods where the impact of the penetration of flat-type Airbnb on housing transaction prices is within the range of 0-2 standard deviations above the average. This covers 21.43% of Greater London's neighbourhoods, indicating a slight increase in housing prices for a large number of neighbourhoods in Greater London. It is imperative to acknowledge that the magnitude of Airbnb's impact is largely determined by flat-type properties.

The clusters with low or negative impacts are relatively few, scattered in different areas. Within these neighbourhoods, there are only 18 neighbourhood where the impact of Airbnb's penetration ratio on housing transaction prices is less than 2 standard deviations below the average. Furthermore, there are 248 neighbourhoods where the impact of Airbnb's penetration ratio on housing transaction prices is between 1-2 standard deviations below the average. They are primarily distributed in the city centre and to the west side. Flat-type Airbnb is lowering the housing prices in very few Greater London neighbourhoods, highlighting its confined disturbing impacts.

2) Within the expansive region of Greater Manchester, the impact of flat-type Airbnb on neighbourhood housing prices exhibits a spatial pattern of lower prices in the central city areas outside the core with L-L clusters in Manchester and slightly higher prices in the suburbs. This pattern suggests a pervasive suppressive effect of flat-type Airbnb within the housing system of Manchester.

The extent of the impact of flat-type Airbnb on neighbourhood house prices suggests that H-H clustered neighbourhoods are rare, with only a few H-L clusters. Specifically, we identified 7 neighbourhoods where Airbnb penetration exceeded

the average by 1 standard deviation and had a significant impact on housing transaction prices. These neighbourhoods are predominantly located in suburban areas closer to the 3km range of Manchester's centre. However, for the vast majority of Greater Manchester, flat-type Airbnb penetration in neighbourhoods has a relatively small positive impact on housing transaction prices. This means that flat-type Airbnb has had a limited boost in Greater Manchester.

The extent of the impact of flat-type Airbnb on neighbourhood house prices suggests that L-L clustered neighbourhoods are more prevalent. The clustering of the negative impact in Greater Manchester is more significant. The areas around Manchester city centre and the clusters in Oldham form low or negative impact areas, which together make up approximately 21.52% of the neighbourhoods in Greater Manchester. Areas around Manchester city centre have a negative impact on house prices, despite being heavily penetrated by Airbnb. The presence of Airbnb in some of the suburbs also has a negative impact. Of these, there are 37 neighbourhoods where Airbnb penetration has an impact that is 4 standard deviations below the mean, mostly located in the L-L cluster, where flat-type Airbnb has led to a decline in neighbourhood stability, resulting in a slight depreciation of housing prices in these neighbourhoods. The misuse of flat properties as Airbnb had a negative impact on housing transaction prices in around 8.31% of Greater Manchester neighbourhoods, suggesting that Airbnb may be disruptive to some neighbourhoods.

3) In Bristol, the impact of flat-type Airbnb on local housing prices also shows a spatial pattern of slightly lower impacts within a 3km radius of the city centre and slightly greater impacts in some eastern outer city suburbs. It appears that flat-type Airbnb has subtly enhanced the housing price levels in areas with mid-range property values, rather than areas with high property values.

It's hard to find H-H or H-L clusters. There are 6 neighbourhoods with flat-type Airbnb property caused premiums that exceed the mean by 1 standard deviation, and these neighbourhoods are located 2km away in low to medium value areas.

The L-L clusters cover most neighbourhoods radiating 2.5km northwest from the city centre and some neighbourhoods on the south bank of the river Avon. This is a relatively affluent area of Bristol with a large number of international students. These characteristics determine that flat-type Airbnb has a limited impact on local housing prices. There are 35 neighbourhoods where the premium rate of flat-type Airbnb on neighbourhood housing transaction prices is 1 standard deviations below the average, indicating that flat-type Airbnb only exerts some negative impacts on housing prices in several places. The socio-economic status of residents in these areas is higher who prefer the stability of the neighbourhoods, and the number of houses rented to Airbnb by landlords is relatively small. In addition, there are more international students, who may have less demand for short-term

rentals of house type. In brief, the negative externalities of flat-type Airbnb on the local community are presented.

7.2.2.3 Summary for different types of Airbnb properties

Airbnb's influence on housing prices, whether for house or flat types, is more pronounced in suburban areas than in city centres. This is largely attributable to the relative stability of suburban housing supply, which renders it vulnerable to shortages, even those caused by minor disruptions. In contrast, the inherent high prices and stability of the housing market in central locations limit the potential for premium when properties are utilised as Airbnb rentals, thereby diminishing its impact.

The correlation between the effects of both Airbnb property types on neighbourhood house prices in each city is predominantly influenced by spatial distribution and penetration rates (Agustin Cocola-Gant et al., 2021). Suburbs, characterised by diverse populations, younger demographic structures, higher demand for short-term rentals, and lower Airbnb penetration rates, often emerge as high-premium areas. Conversely, areas experiencing negative impacts are typically city centres and surrounding communities with a relatively high socioeconomic status, because frequent turnover of Airbnb guests can disrupt the sense of community in residential neighbourhoods.

The disparity in Airbnb's impact on neighbourhood housing prices between house-type and flat-type properties is significant across three cities. Despite a lower average premium rate, house-type Airbnb properties exert a greater influence in certain suburban neighbourhoods, a trend that is particularly noticeable in Greater London and Bristol (Voltes-Dorta & Sánchez-Medina, 2020). However, these properties also have a slightly lower or even negative impact on housing prices in city centre neighbourhoods (Cheung & Yiu, 2023), a pattern observed in all three cities.

In contrast, flat-type Airbnb properties have a positive impact in the city centres of Greater London and Bristol, but a negative one in Manchester. The affordability of suburban housing makes it an attractive investment for Airbnb rentals, especially for house-type properties. Airbnb offers a means to capitalise on vacant properties, attracting income and outsiders, thereby stimulating the suburban housing market.

7.2.3 Neighbourhood heterogeneity in the implied impact of Airbnb with different bedroom numbers on house prices

By incorporating random effects at neighbourhood level, an empirical analysis was conducted on the impact of varying bedroom numbers on residential transaction prices across three cities. After numerous iterations, the model

converged, with the estimated results of the multi-level regression model presented in Table 7-5.

Table 7-5 Hybrid repeat sales multi-level model for different bedroom numbers of Airbnb properties.

	Different bedrooms	
Predictors	*B*	*SE*
(Intercept)	1.874 ***	0.047
pct_air_bdr1	4.406 ***	0.220
pct_air_bdr2	4.144 ***	0.441
pct_air_bdr3	4.193 ***	0.652
pct_air_bdr4	2.372 ***	0.260
log(datebtwn)	-0.051 ***	0.001
dwe_modage	-0.001 ***	0.000
y1996	0.032 ***	0.001
y1997	0.154 ***	0.001
y1998	0.276 ***	0.001
y1999	0.401 ***	0.001
y2000	0.577 ***	0.001
y2001	0.688 ***	0.001
y2002	0.842 ***	0.001
y2003	0.983 ***	0.001
y2004	1.092 ***	0.002
y2005	1.142 ***	0.002
y2006	1.206 ***	0.002
y2007	1.325 ***	0.002
y2008	1.328 ***	0.002
y2009	1.231 ***	0.002
y2010	1.303 ***	0.002
y2011	1.315 ***	0.002

y2012	1.346 ***	0.002
y2013	1.399 ***	0.002
y2014	1.513 ***	0.002
y2015	1.577 ***	0.003
y2016	1.645 ***	0.003
y2017	1.666 ***	0.003
y2018	1.667 ***	0.003
y2019	1.662 ***	0.003
Random Effects		
σ^2	0.079	
$\tau_{00\ lsoa11cd}$	0.004	
$\tau_{11\ lsoa11cd.pct\_air\_bdr1}$	27.689	
$\tau_{11\ lsoa11cd.pct\_air\_bdr2}$	167.989	
$\tau_{11\ lsoa11cd.pct\_air\_bdr3}$	211.766	
$\tau_{11\ lsoa11cd.pct\_air\_bdr4}$	17.934	
$N_{lsoa11cd}$	6771	
Observations	1642557	
Marginal R^2 / Conditional R^2	0.572 / 0.593	
AIC	2186496.772	
log-Likelihood	-257770.946	

** p<0.05 ** p<0.01 *** p<0.001*

Figure 7-8 gives the distribution of standardised residuals from the multilevel model regression, with the standardised residuals from the local regression model being spatially and completely randomly distributed. This indicates that the multilevel model regression results are overall more satisfactory.

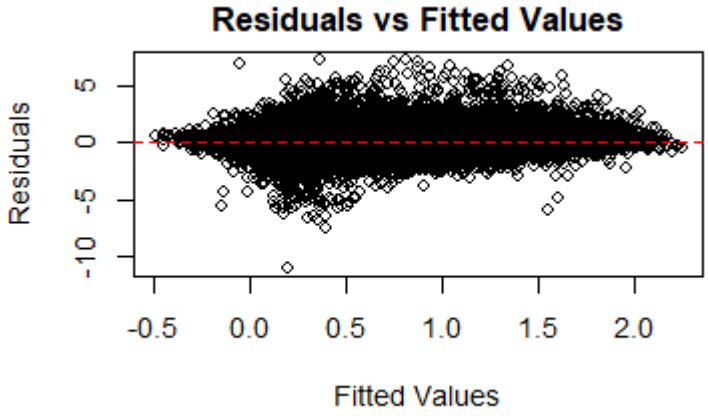


Figure 7-8 The distribution of standardised residuals from the multi-level model for different bedroom numbers of Airbnb properties.

Given the parameters enumerated in the table, the unexplained variance in the model σ^2 is 0.079. A multi-level model reveals that at level two, the specific variance of the model intercept is 0.004. The specific variance related to the model slope term associated with variable pct_air_bdr1 is 27.689; with pct_air_bdr2, it's 167.989; with pct_air_bdr3, the variance reaches 211.766, and with pct_air_bdr4, it is 17.934. This indicates a significant degree of variability or heterogeneity of two and three-bedroom Airbnb properties on the neighbourhood level. The variation in starting house price change rates among different neighbourhoods is relatively small. In contrast, the impact of Airbnb properties varies dramatically from neighbourhood to neighbourhood. The model's Marginal R^2, and Conditional R^2 are 57.2% and 59.3%, respectively, slightly higher than the 55.1% of a regular linear model, suggesting improved goodness-of-fit. In comparison to ordinary linear models, the model's AIC statistic has dropped, and the log-Likelihood has noticeably increased. The likelihood-ratio statistic of the two models is -2log(likelihood) = -2*(-304212-(-257771)) = 92882, which is significant on a Chi-squared distribution at the 0.001 level on 2 D.F. The significant statistical difference between AIC and log-Likelihood indicators suggests that the two-level regression mixed-effects model fits data better than the ordinary linear model.

Secondly, the fixed-effect parameter estimates from the table indicate that on a confidence level of 0.001, coefficients for the intercept and all variable slope terms on fixed effects have passed the statistical significance test. The slope term for pct_air_bdr1 suggests that for every 1% growth in the proportion of neighbourhood housing occupied by Airbnb, house prices average a 4.5% increase ($e^{\left(\frac{4.406}{100}\right)}$-1=4.5%). For pct_air_bdr2, the estimated rise is 4.231% ($e^{\left(\frac{4.144}{100}\right)}$-1=4.231%), for pct_air_bdr3, it's 4.282% ($e^{\left(\frac{4.193}{100}\right)}$-1=4.282%), and for pct_air_bdr4, it is 2.4% ($e^{\left(\frac{2.372}{100}\right)}$-1=2.4%). These estimations differ considerably from those of the ordinary linear model.

Distinguishing customer groups for different bedroom numbers in Airbnb listings impact each neighbourhood's house price growth rate significantly through neighbourhood effects and spatial differences. It brings out the necessity to delve more profoundly into the differences in house price growth rates across various neighbourhoods and delve into the differential mechanisms of Airbnb effects.

Table 7-6 lists the minimum, lower quartile, median, upper quartile, and maximum values of the random slopes of pct_air_bdr1, pct_air_bdr2, pct_air_bdr3 and pct_air_bdr4. The coefficients of the random-effects part are basically normally distributed, but it can still be found that the impact coefficients of Airbnb with different bedroom numbers vary greatly among different neighbourhoods. Based on the random-effects results of the multi-level model, it is a good idea to visualise the regression results, to intuitively present the spatial distribution and heterogeneity of the impact of different bedroom numbers of Airbnb on housing price growth.

Table 7-6 Random slope distribution of multi-level hybrid repeat sales model for different bedroom numbers of Airbnb in three cities.

	Region(N)	P0	P25	P50	P75	P100
pct_air_bdr1	Bristol (263)	-2.65	3.39	4.41	4.41	9.72
	Greater London (4835)	-10.48	4.19	4.41	4.41	21.86
	Greater Manchester (1673)	-13.38	4.41	4.41	4.41	8.75
pct_air_bdr2	Bristol (263)	-8.34	2.03	4.14	4.14	36.00
	Greater London (4835)	-13.24	3.49	4.14	4.14	48.59
	Greater Manchester (1673)	-63.70	4.14	4.14	4.14	28.72
pct_air_bdr3	Bristol (263)	-5.60	4.19	4.19	4.19	28.38
	Greater London (4835)	-9.02	4.19	4.19	4.19	46.30
	Greater Manchester (1673)	-66.87	4.19	4.19	4.19	24.67

pct_air_bdr4	Bristol (263)	-0.32	2.37	2.37	2.37	4.96
	Greater London (4835)	-3.03	2.37	2.37	2.37	11.97
	Greater Manchester (1673)	-15.32	2.37	2.37	2.37	6.17

7.2.3.1 Heterogeneous impact of one-bedroom Airbnb properties

In order to gain insights into the nuanced impact of one-bedroom Airbnb on neighbourhood housing prices growth rates, one can derive the overall effect for each neighbourhood by combining the estimated coefficient of the coefficient for pct_air_bdr1 in the fixed effects with the corresponding value for random effects. Then, employing a standard deviation classification method to divide these into 8 categories can intuitively reflect the between-neighbourhood heterogeneous characteristics of the proportion of one-bedroom Airbnb. By examining the spatial distribution depicted in the Figure 7-9, the pattern is discernible. Intriguingly, a similar pattern emerges for flat-type Airbnb. However, further investigation is needed to disentangle the underlying drivers.

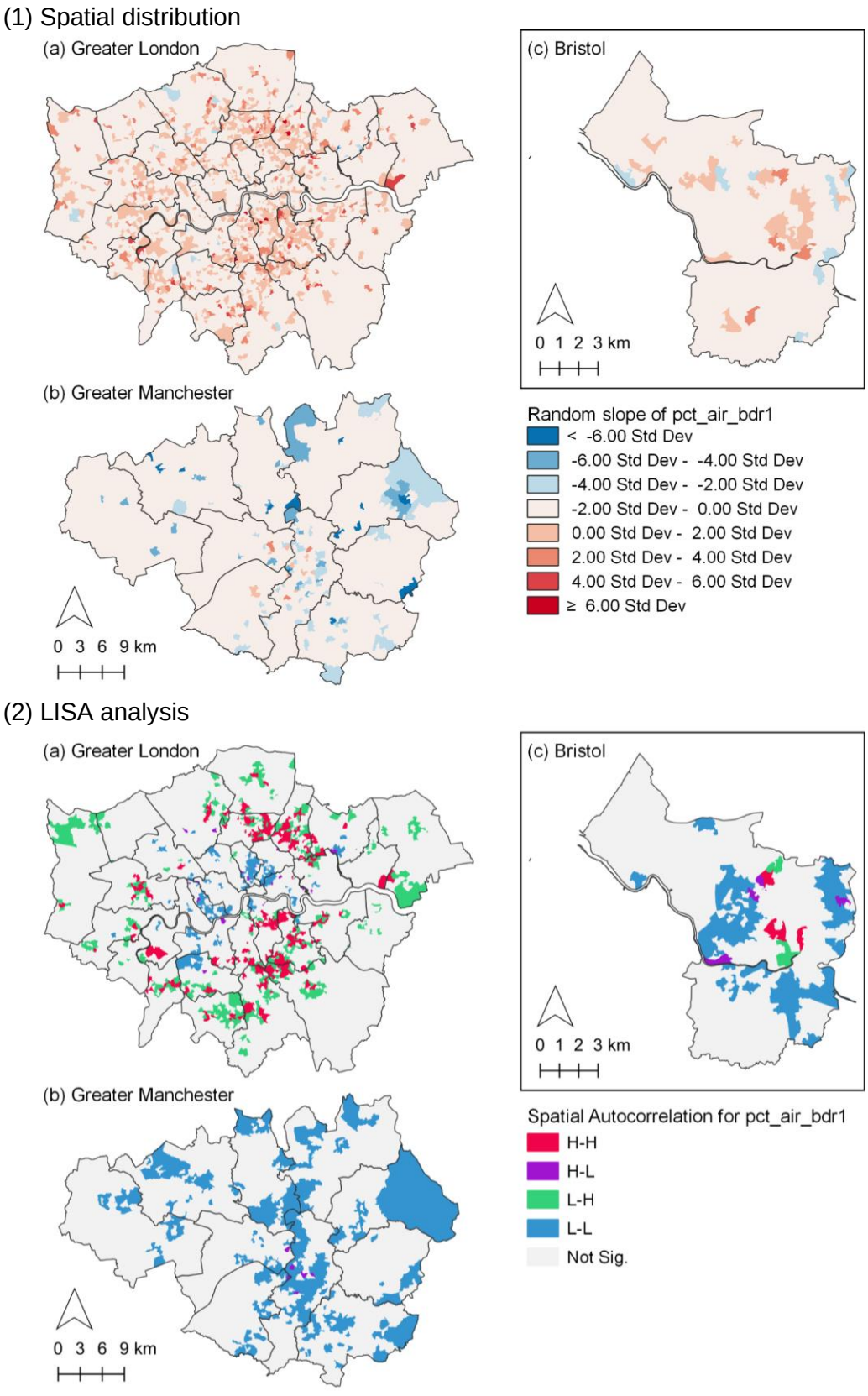


Figure 7-9 Spatial distribution of the random slopes of pct_air_bdr1 and its LISA analysis across three cities. (Own elaboration)

1) In the Greater London area, the impact of one-bedroom Airbnb listings on neighbourhood housing prices manifests a spatial distribution pattern akin to that of flat-style Airbnb accommodations. The impact is notably subdued in Central London, an area traditionally associated with peak property values. Conversely, certain suburbs, typically characterised by more modest property values, exhibit a more pronounced impact. Several bands in the edge of Inner London are home to H-H clusters where Airbnb notably influences local housing prices.

These bands primarily include South Tottenham and Waltham Forest in the northeastern suburbs, along with Peckham and Crystal Palace in the southern suburbs of Greater London. Although these areas partially overlap with the location of flat-type Airbnb H-H clusters, they also contain unique neighbourhoods that set them apart. These areas, with their unique touristic characteristics, hold a certain appeal for Airbnb users. Consequently, property prices in these localities are particularly vulnerable to inflationary pressures triggered by the presence of one-bedroom Airbnb listings. Within these clusters, 9 communities exhibited impacts on housing transaction prices from one-bedroom Airbnb penetration rates that were over 6 standard deviations above average. These communities were primarily distributed across three clusters. 41 communities had impacts ranging between 4 to 6 standard deviations above average, while 179 neighbourhoods had impacts 2 to 4 standard deviations above average from their one-bedroom Airbnb penetration rates. The relatively widespread distribution of these communities indicates that neighbourhoods with dramatic impacts far exceeding average are not highly prevalent across Greater London.

There are fewer low impact or negative impact clusters, scattered in northwestern London. These were primarily located in middle to high income communities. Just one unique neighbourhood in Ilford exhibited an impact on housing transaction prices that was under 6 standard deviations below average. Additionally, 28 neighbourhoods had impacts ranging between 2 to 4 standard deviations below average. Although the proportion of one-bedroom Airbnb activity in these areas was low, even a small presence could readily deteriorate the overall community atmosphere and exert a suppressive effect on property values.

2) The impact of one-bedroom Airbnb in Greater Manchester diverges somewhat from the trends seen in Greater London. It exhibits a spatial pattern of large clusters of lower impacts within the central city, outside of the core yet extending into surrounding local authorities and suburban towns and only a few H-L neighbourhoods immediately around the city centre.

The degree of influence of one-bedroom Airbnb on community housing prices shows that H-H clusters are rare, while there are several H-L clusters. This indicates that in Greater Manchester, the impact of one-bedroom Airbnb on housing transaction prices is relatively low and not widespread, and only a few neighbourhood clusters have generated higher housing price premiums. Among

them, there are 3 neighbourhoods where the Airbnb penetration rate exceeds the average by 2-4 standard deviations, thus having a significant positive impact on housing transaction prices. These neighbourhoods are mainly located in the low-value neighbourhoods of Salford and Manchester administrative districts, 3-5 km from the city centre in a straight line. In fact, in Greater Manchester, one-bedroom Airbnb has a positive impact on housing transaction prices in 189 neighbourhoods (more than 11.3% of the total number of neighbourhoods in Greater London), but in most areas, the penetration rate of one-bedroom Airbnb is not high, and it only has a potential positive impact on most areas, indicating that one-bedroom Airbnb does not significantly deprive local residents of home buying opportunities, but rather increases community vitality.

The areas with a low or negative impact form a wide cluster from the outskirts of Manchester city centre to Oldham, Bolton and Stockport. Many neighbourhoods in Greater Manchester have a large number of one-bedroom properties penetrated by Airbnb, but this has a negative impact on neighbourhood house prices. Airbnb's presence in some suburbs has an even greater negative impact on house prices, indicating that Airbnb's invasion of one-bedroom properties may have seriously affected the normal house prices in Manchester neighbourhoods. Among them, there are 42 neighbourhoods where the impact of Airbnb's penetration on house prices is below the average by 4 standard deviations. These neighbourhoods are mostly located in the L-L clusters of the outskirts and far suburbs of Manchester city centre. In addition, there are 62 neighbourhoods where the impact of Airbnb on house prices is below the average by 2-4 standard deviations, which are mainly located in various clusters with poor living environment and housing conditions. In Greater Manchester, about 1.43% of the neighbourhoods have a negative impact on house prices due to the misuse of one-bedroom properties as Airbnb. This shows that one-bedroom Airbnb has a relatively weak role in pushing up house prices in Greater Manchester, and the neighbourhoods with negative impact are indeed more than the other two cities.

3) In Bristol, the impact of one-bedroom Airbnb on neighbourhood housing prices also shows a spatial pattern of L-L clusters extending outwards from the city centre beyond a 1km radius while only a few outer northeastern suburbs exhibited H-H clusters. The disparity between L-L and H-H clusters suggests heterogeneous influence according to property characteristics and values.

The areas with a high premium are not many. One is Easton, located to the east of the city centre, and the other is near the Memorial Stadium in Horfield. Although these neighbourhoods are not in the city centre, they have a relatively more open and inclusive environment, with specific attractions. It is noteworthy that there are 4 neighbourhoods where the premium rate of one-bedroom Airbnb properties exceeds the average by 2 standard deviations, and these neighbourhoods are strategically located near the low-price areas in the south and northeast. There are

24 neighbourhoods where the premium rate of one-bedroom Airbnb properties on Bristol neighbourhood house prices is within 2 standard deviations above the average, and in fact, one-bedroom Airbnb has a more or less potential positive impact on almost all neighbourhoods in Bristol.

The L-L clusters cover three main areas, one is most of the neighbourhoods radiating 2.5 km to the northwest from the city centre, which is the middle zone connecting the city centre and the affluent areas, and also the student gathering area. The other two are some areas in the east end and some neighbourhoods with low housing value but better housing conditions on the southeast bank of the river Avon. There are 12 neighbourhoods where the premium rate of one-bedroom Airbnb on neighbourhood house prices is below the average by 2-4 standard deviations, indicating that Airbnb has a slight positive impact on house prices in limited neighbourhoods. These areas are remote and lack tourism or business activity resources that attract outsiders, so the demand for short-term rentals of one-bedroom type may be less. In short, one-bedroom Airbnb does not have a significant inhibitory effect on local house prices, which reflects the good socio-economic foundation of these areas in Bristol.

7.2.3.2 Heterogeneous impact of two-bedroom Airbnb properties

Two-bedroom Airbnb accounts for a significant portion of the overall short-term rental market. To further comprehend the heterogeneous impact of two-bedroom Airbnb, the total effect for each neighbourhood is obtained by adding the estimated value of the coefficient of pct_air_bdr2 in the fixed effects to the corresponding random effects coefficient. Subsequently, the standard deviation classification method is used to divide these into 10 levels, which can intuitively reflect the between-neighbourhood heterogeneous characteristics of the proportion of two-bedroom Airbnb on the growth rate of neighbourhood housing prices (see Figure 7-10).

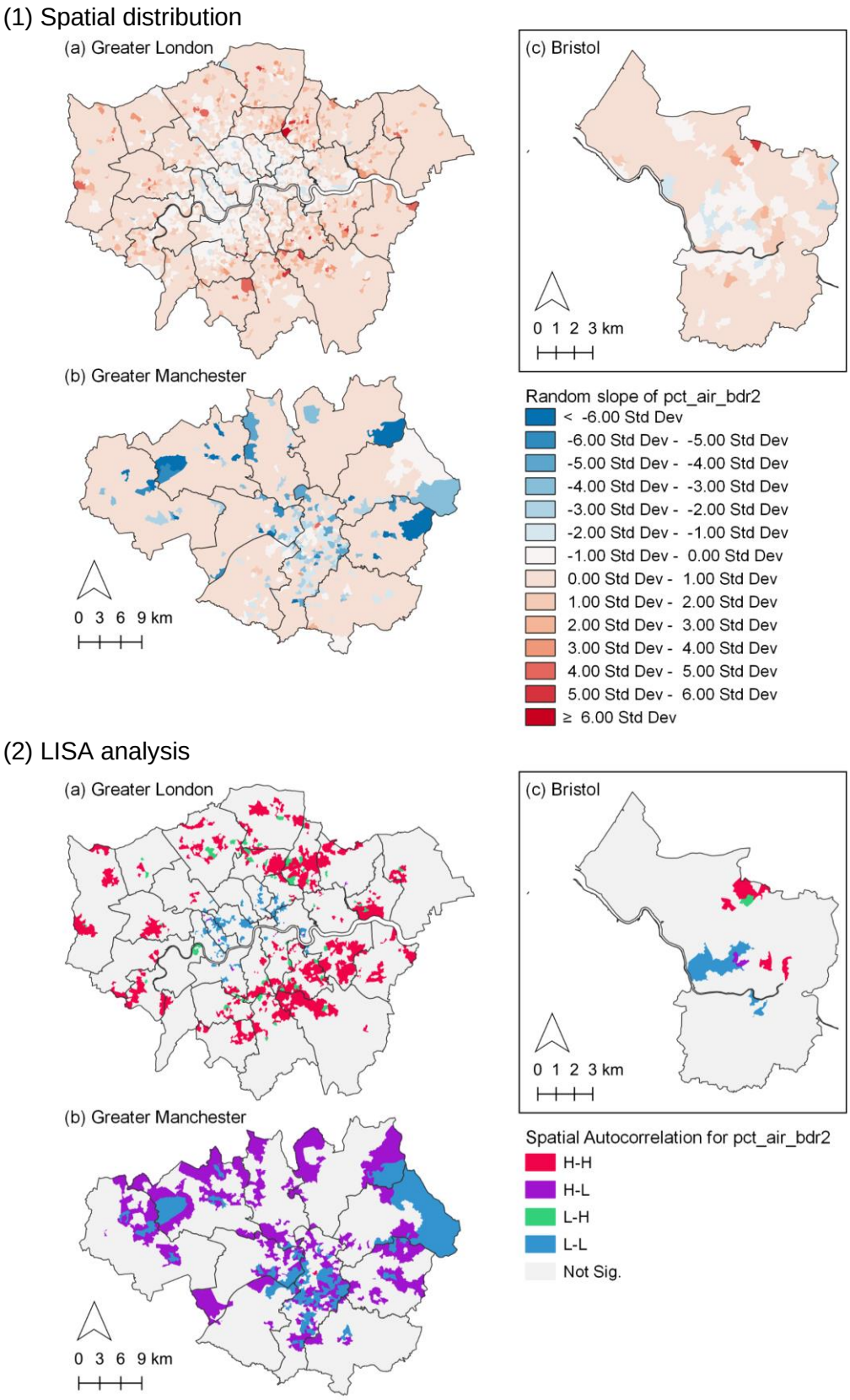


Figure 7-10 Spatial distribution of the random slopes of pct_air_bdr2 and its LISA analysis across three cities. (Own elaboration)

1) In Greater London, the impact of two-bedroom Airbnb listings on neighbourhood housing prices exhibits a core-periphery distribution. This trend is characterised by L-L clusters in Inner London, several high-value agglomeration zones radiating in a belt-like pattern in the northeastern and southeastern areas, and several high-value agglomeration points in remote towns, along with slightly positive impacts in the suburbs.

Two H-H radiation belts are more extensive in the outskirts of London, and several clusters are scattered in the suburbs. Of note, two-bedroom Airbnb property supply in these regions might be highly inelastic. Hence, the widespread utilisation of two-bedroom houses by Airbnb has a marked impact on this segment of the market. In these neighbourhood clusters, 39 neighbourhoods exceed the average impact level of two-bedroom Airbnb penetration on housing transaction prices by four standard deviations. These communities are primarily scattered around suburban areas, predominantly white, middle-class neighbourhoods. Moreover, in 204 communities, the impact of two-bedroom Airbnb penetration on housing premium rates is between 2-4 standard deviations above the average. These neighbourhoods are widespread and essentially make up all H-H congregated areas. Indeed, as the most common house type, two-bedroom Airbnb has led to a significant price increase in 43.76% of communities in Greater London due to its penetration.

Low-impact or negatively affected clusters are concentrated in the heart of London, especially around some tourist attractions, accounting for about 2.5% of the total number of communities in Greater London. These neighbourhoods, located in high-density metropolitan core areas with high property values, don't show significant spillover effects from Airbnb rentals, and the surrounding property market experiences minimal fluctuations. In these neighbourhoods, 137 have a two-bedroom Airbnb penetration rate that's 1 standard deviation below the average impact on housing transaction prices. These are mainly concentrated in Inner London, where the penetration rate of two-bedroom Airbnb listings is slightly high. According to statistical summaries, in only 8.11% of communities in Greater London did two-bedroom Airbnb properties adversely affect housing transaction prices. When two-bedroom properties are infiltrated by Airbnb, the slight negative impact on local housing market prices in London is primarily concentrated in the city centre.

2) In Greater Manchester, the impact of two-bedroom Airbnb on neighbourhood housing prices exhibits a spatial pattern of the centre collapse. This trend is characterised by slight negative impacts in large areas of Manchester and minor rising impacts in most suburbs.

H-H clusters affected by two-bedroom Airbnb properties are rare in Manchester, but H-L clusters are widespread. This spatial pattern indicates that two-bedroom Airbnb properties only boost property prices in some individual

neighbourhoods of Manchester, especially those around the city centre. Categorised statistics show that only four neighbourhoods have two-bedroom Airbnb penetration rates affecting housing transaction prices which exceed the average level by two standard deviations. These communities are mainly distributed in some suburban areas with poorer living conditions. In fact, as a very common type of housing, the penetration of two-bedroom Airbnb has led to a sharp increase in housing prices in 4.72% of neighbourhoods in Manchester, and potentially weak increases in 82.85% of neighbourhoods.

Neighbourhood clusters with low impact or negative impact are scattered around downtown Manchester and have spread to all places like Oldham, Bolton, and Wigan. These neighbourhoods, located in the periphery of the city where property values are slightly lower and poverty slightly higher, may have their local residential atmosphere disrupted by Airbnb rentals, thus increasing the instability of living conditions. In these neighbourhoods, 55 have a two-bedroom Airbnb penetration rate that is four standard deviations below the average impact on housing transaction prices. Though locally clustered, they are dispersed across several remote boroughs. In addition, there are 63 neighbourhoods with two-bedroom Airbnb penetration rates that are 2-4 standard deviations below the average impact on housing prices. According to the statistical summary, in 12.43% of the communities in Greater Manchester, two-bedroom Airbnb properties have had a negative impact on housing transaction prices. The widespread negative impact of Airbnb's penetration into two-bedroom properties on local housing market prices in Manchester can be attributed to several factors. On one hand, these neighbourhoods are not popular with tourists due to poor public safety. On the other hand, the use of two-bedroom properties, a necessity in the housing market, as Airbnb properties significantly affects the local real estate market value.

3) In Bristol, the impact of two-bedroom Airbnb on neighbourhood housing prices shows a spatial pattern of a low value core and minor positive value in the periphery. This pattern is characterised by a horizontal long shape Low-Low cluster from Bristol city centre to Clifton suspension bridge, High-High clusters in a couple of economically decent suburban towns.

Neighbourhood clusters with higher housing price premiums for two-bedroom Airbnb properties are mainly found in the eastern part of the city centre, Horfield and Easton. Although these clusters are not in the city centre, they offer good living conditions and low poverty rates. It is worth noting that there are two neighbourhoods with two-bedroom Airbnb property premiums exceeding the average level by 3 standard deviations, and three neighbourhoods whose two-bedroom Airbnb premium rate for housing transaction prices in Bristol exceeds the average level by 2-3 standard deviations. The locations of these neighbourhoods are mainly within the two clusters. Although these neighbourhoods have relatively abundant housing resources, the housing prices in these two areas are relatively

moderate, and Victorian terraced houses are the most common type. Well-equipped two-bedroom units give owners the motivation to rent their properties on Airbnb.

L-L clusters cover a strip of land radiating from the city centre to the Clifton Suspension Bridge, 4 km to the west. There are 13 neighbourhoods with a two-bedroom Airbnb premium rate on neighbourhood housing transaction prices lower than the average level by one standard deviation. This indicates that the impact of two-bedroom Airbnb properties on Bristol's lower limit is relatively high, only slightly negatively affecting property prices in a limited number of neighbourhoods. This is mainly due to the high-end housing, high property prices, and higher income levels of residents in these areas. Residents in these areas are sensitive to the disruption caused by Airbnb and are not willing to rent their properties. In addition, the vicinity of the university district reduces the motivation for property owners to rent, as a substantial number of properties are rented by students. Additionally, as the area is convenient for transport, close to the city centre, and well-equipped with amenities, residents do not need to rely on Airbnb. Although two-bedroom Airbnb properties have negative externalities in the local community, due to these multiple factors, this negative impact is not widespread in this area.

7.2.3.3 Heterogeneous impact of three-bedroom Airbnb properties

Three-bedroom units are likely to accommodate families or larger groups. This influences the type of tourism they cater to compared to smaller Airbnb properties. To comprehend its spatial market segmentation, the total effect for each neighbourhood is obtained by adding the estimated value of the coefficient of pct_air_bdr3 in the fixed effects to the corresponding random effects coefficient. Subsequently, the standard deviation classification method is used to divide these into 18 levels, which can intuitively reflect the between-neighbourhood heterogeneous characteristics of the proportion of three-bedroom Airbnb on the growth rate of neighbourhood housing prices. In terms of its spatial distribution (as depicted in the Figure 7-11), the agglomerative effect of three-bedroom Airbnb listings on housing price growth is more limited compared to one and two-bedroom listings.

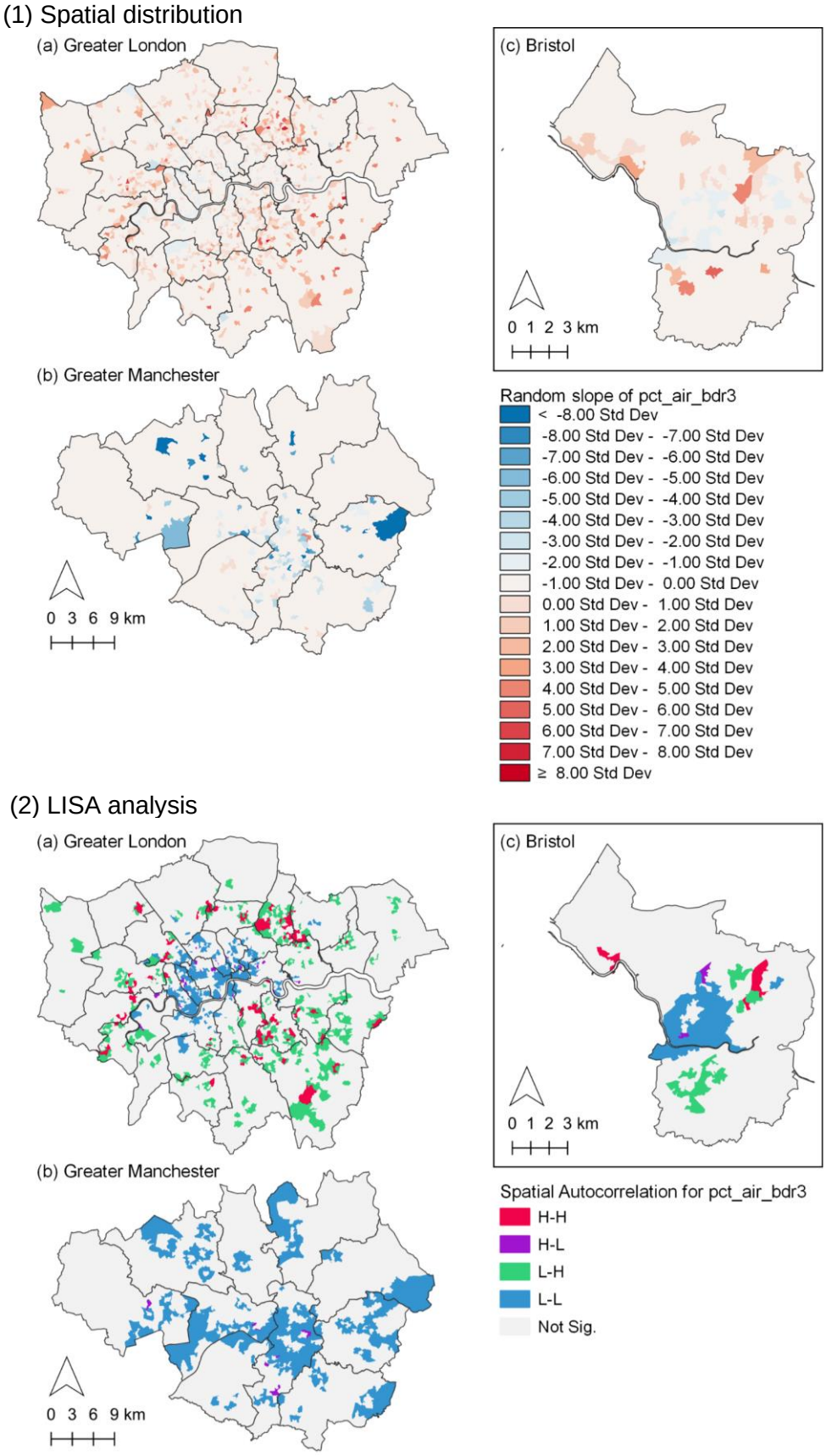


Figure 7-11 Spatial distribution of the random slopes of pct_air_bdr3 and its LISA analysis across three cities. (Own elaboration)

1) In Greater London, the impact of three-bedroom Airbnb listings on neighbourhood housing prices shows a low value core and interwoven periphery. This trend is characterised by Low-Low clusters in Inner London, and slightly positive or negative impacts interwoven in the suburbs and sporadic "hotspots" appearing in the northeastern and southeastern suburbs.

In terms of neighbourhoods where three-bedroom Airbnb properties have formed a H-H cluster, they are sparse and scattered in Walthamstow and Lewisham, as well as some suburban neighbourhoods in the west. Within the Greater London clusters, there are 65 communities where the penetration of Airbnb properties has an impact on housing transaction prices exceeding the average by four standard deviations. There are also 142 communities where the influence of Airbnb property penetration rates on housing transaction prices lies between two and four standard deviations above the average. These communities are widely distributed, some in the metropolitan area and others in multicultural urban blocks. The summarised analysis has revealed that three-bedroom Airbnb properties have a positive effect on housing transaction prices in 1,610 neighbourhoods. This extensive coverage range includes a third of the communities in Greater London, while they also have a potentially positive effect on 3,002 neighbourhoods, suggesting that the house prices in most communities in Greater London have risen, either substantially or potentially. Although the influence of three-bedroom Airbnb properties on neighbourhood housing prices is widespread, high values remain concentrated in a few areas.

Clusters of low or negative influences are confined within Inner London. These neighbourhoods are located in high-density metropolitan core areas, surrounded by properties and communities of middle-to-high income, where the property values are at the top level. The negative externalities of Airbnb may already have invaded the city and residential environment, ultimately having an adverse effect on housing prices. Among these communities, there are seven located in the outskirts of metropolitan areas where the impact of the three-bedroom Airbnb penetration rate was below the average by 2 standard deviations. In addition, there are also 175 neighbourhoods in the central and southwest parts where the impact of the three-bedroom Airbnb penetration rate on housing transaction prices was below the average by 1-2 standard deviations. As a type of accommodation suitable for long-term stay, the significant presence of Airbnb in these places has made people feel that the atmosphere in the entire community is deteriorating, thereby suppressing property values. According to the statistical summary, in about 4.61% of the communities in Greater London, the Airbnb listings according to housing type have evidently had an adverse effect on house prices.

2) In Greater Manchester, the impact of three-bedroom Airbnb on neighbourhood housing prices exhibits a spatial pattern of radiocentric-dispersion. This trend is characterised by slight negative impacts in peri-urban

areas of Manchester and the low impacts are emanating from the centre with radial corridors (see also Wegmann & Jiao, 2017) to Bolton, Salford and Tameside.

There are no H-H clusters where three-bedroom Airbnb has a high impact on house prices, and only 7 H-L neighbourhoods are around the town centre. In the clusters of Greater Manchester, there is only one neighbourhood where the impact of Airbnb property type penetration on house prices exceeds the average by 4 standard deviations. This unique neighbourhood is located in Openshaw, an old industrial area, and close to the Etihad Stadium, where multi-occupancy three-bedroom properties are likely to be occupied by Airbnb. By aggregating the analysis, it is found that only 42 neighbourhoods have a positive impact on house prices due to three-bedroom Airbnb, and these neighbourhoods are mainly located in the core areas of Manchester, Salford, and Trafford. In addition, there are 1,522 neighbourhoods where three-bedroom Airbnb has a potential positive impact on house prices, indicating that the high-value impact of three-bedroom Airbnb on neighbourhood house prices is concentrated in a few areas.

The L-L areas with a low or negative impact spread within the scope of various boroughs. Due to the lack of necessary tourism resources in Greater Manchester, and the fact that three-bedroom properties used for Airbnb easily disturb the living environment of residents, it eventually has an adverse impact on house prices. In these neighbourhoods, there are 24 neighbourhoods located in the outskirts or suburban boroughs of Manchester's central activity area, where the impact of three-bedroom Airbnb penetration is below the average by 6 standard deviations. In addition, there are 17 neighbourhoods where the impact of three-bedroom Airbnb penetration is below the average by 4-6 standard deviations, and 29 neighbourhoods, mostly located in Manchester, where the impact of three-bedroom Airbnb penetration is below the average by 2-4 standard deviations. According to the statistical summary, in Greater Manchester, about 6.52% of the neighbourhoods have an adverse impact on house prices due to the three-bedroom Airbnb properties. Three-bedroom as a suitable room type for permanent residence, the visible presence of Airbnb activity tends to have a suppressing effect on property values, and this disruptive effect is greater in the more remote and tranquil areas.

3) In Bristol, the impact of three-bedroom Airbnb listings on neighbourhood housing prices still follows a monocentric model characterised by a central collapse and radiating suburbs. This pattern features a large Low-Low cluster extending 2km from Bristol city centre, while High-High clusters exist in a few suburban towns with good local services.

There are few H-H clusters where three-bedroom Airbnb has a high impact on house prices, and only 4 neighbourhoods are around the town centre. In the neighbourhoods of Bristol, only 3 neighbourhoods located in Easton, Windmill Hill and other ordinary class residential areas have an impact of Airbnb property type

penetration on house prices that exceeds the average by 4 standard deviations, and another 4 neighbourhoods have an impact that exceeds the average by 2-4 standard deviations. By aggregating the analysis, it is found that 68 neighbourhoods – about a quarter of Bristol – have a positive impact on house prices due to three-bedroom Airbnb, and these neighbourhoods are mainly located in the suburbs where the middle class live. In addition, there are 172 neighbourhoods where three-bedroom Airbnb has a potential positive impact on house prices, indicating that the high-value impact of three-bedroom Airbnb on neighbourhood house prices is concentrated in a few areas, but its impact on house prices in various districts of Bristol is widespread.

The L-L areas with a low or negative impact are concentrated within a radius of about 2.5km around the city centre. In these neighbourhoods, there are 2 neighbourhoods where the impact of three-bedroom Airbnb penetration is below the average by 2 standard deviations, mainly distributed in the Ashley and Clifton areas, and another 17 neighbourhoods where the impact is below the average by 1-2 standard deviations, covering most of the city centre area. According to the statistical summary, in Bristol, about 8.75% of the neighbourhoods have an adverse impact on house prices due to the three-bedroom Airbnb properties. It can be seen that the inhibitory effect of three-bedroom Airbnb on property value in Bristol is geographically concentrated.

7.2.3.4 Heterogeneous impact of above four-bedroom Airbnb properties

Larger homes may cater more to international tourism over domestic travellers. This influences local economies differently. To shed light on heterogeneous local consequences of above four-bedroom Airbnb, the total effect for each neighbourhood is obtained by adding the estimated value of the coefficient of pct_air_bdr4 in the fixed effects to the corresponding random effects coefficient. Subsequently, the standard deviation classification method is used to divide these into 10 levels, which can intuitively reflect the between-neighbourhood heterogeneous characteristics of the proportion of above four-bedroom Airbnb on the growth rate of neighbourhood housing prices. From its spatial distribution (Figure 7-12), neighbourhoods with high impact levels appear in areas different from those of other types of housing.

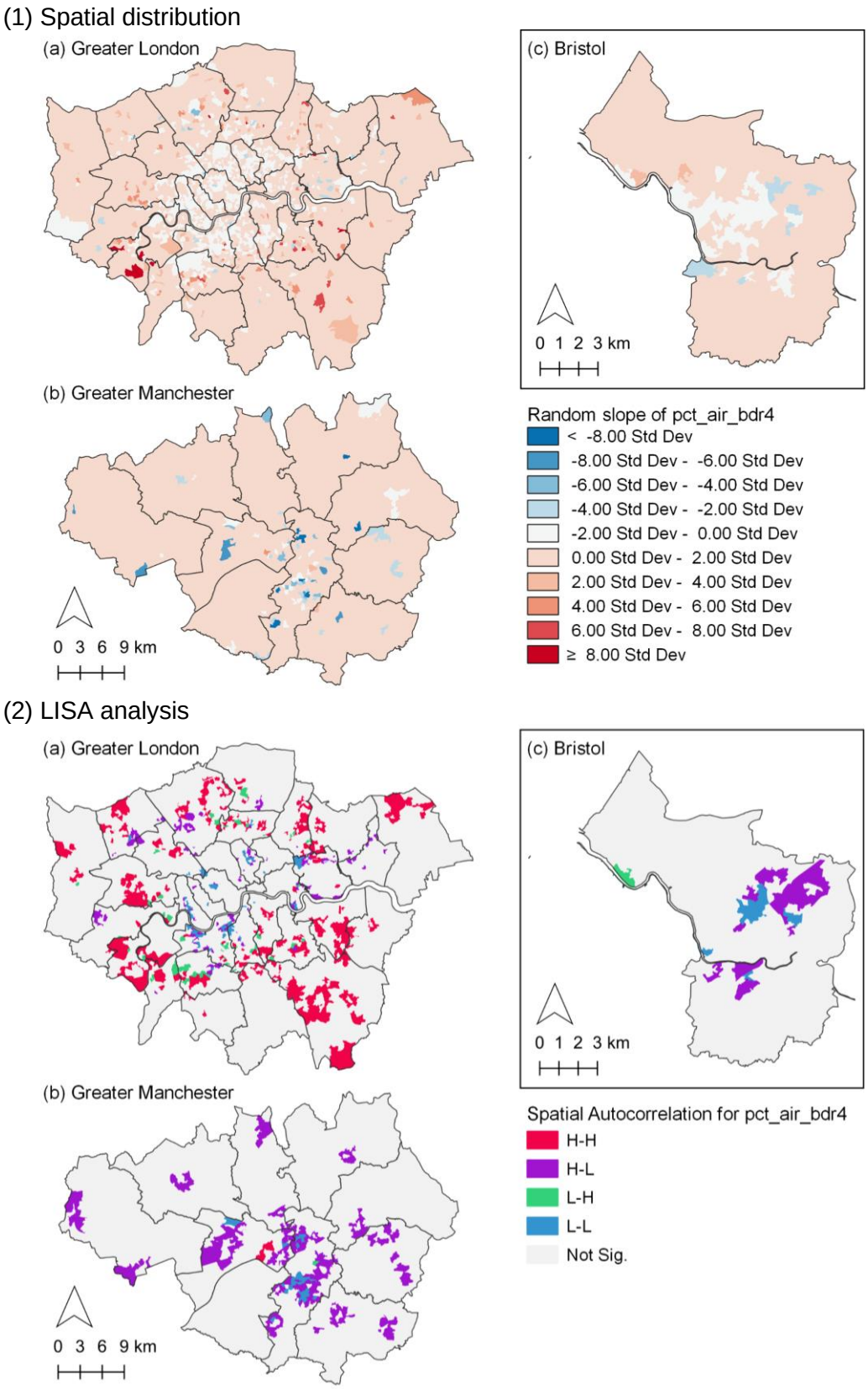


Figure 7-12 Spatial distribution of the random slopes of pct_air_bdr4 and its LISA analysis across three cities. (Own elaboration)

1) In Greater London, the impact of Airbnb listings with more than four bedrooms on neighbourhood housing prices exhibits a suburban dispersion. This trend is characterised by sporadic L-L clusters around Inner London and high-value agglomeration areas dispersed in the suburbs, with slightly positive impacts in the suburbs.

H-H cluster areas of the London outskirts are widely distributed in the suburbs 10km outside of the city centre, and there are also several high-low cluster areas dispersed in the suburbs. It's worth noting that the supply of above four-bedroom properties might be more suburban, hence, the impact of Airbnb on this market segment of above four-bedroom properties is more scattered. According to categorical statistics, there are 10 neighbourhoods where the Airbnb penetration of the above four-bedroom properties exceeds the average housing transaction price by 8 standard deviations, these communities are mainly located in suburban areas such as Richmond upon Thames and Greenwich. There are also 56 communities where the impact of the above four-bedroom Airbnb penetration on the housing premium rate is between 4 and 8 standard deviations above the average; these communities are more broadly distributed. In fact, as high-end units, above four-bedroom Airbnb properties have driven up house prices to a high degree in 27.01% of communities in Greater London. This is mainly due to units of above four bedrooms being suitable for high-income families, and the conversion of some of these Airbnb listings into rentals has reduced the market supply of such residences, consequently raising their prices. However, as suburbs are more spacious with fewer people, the negative externality of Airbnb is smaller, therefore, its promotion effect on suburban house prices is more noticeable.

The areas with a low or negative impact are scattered across a wide range, accounting for only about 1.4% of the total number of neighbourhoods in Greater London. Some small L-L clusters are found in Lambeth, Wandsworth and Hammersmith, which have relatively low property values and a less apparent spill-over effect. Among these neighbourhoods, there are 4 neighbourhoods where the impact of the Airbnb penetration of above four-bedroom properties on housing transaction prices is below the average by 4-8 standard deviations. They are mainly located in Outer London, in boroughs such as Harrow and Barnet. In addition, there are 38 neighbourhoods in 21 out of 33 boroughs where the impact of above four-bedroom Airbnb properties on housing transaction prices is below the average by 2-4 standard deviations. According to statistics, above four-bedroom Airbnb properties have had a very minor and scattered negative impact on housing transaction prices in just 1.3% of neighbourhoods of Greater London.

2) In Greater Manchester, the impact of above four-bedroom Airbnb on neighbourhood housing prices exhibits a spatial pattern of concentration of negative values in Manchester excluding the core. This trend is characterised by

some L-L clusters in the periphery of Manchester city centre and some H-L clusters extending into some suburban towns.

Only five areas exhibit a H-H clustering concerning the impact of Airbnb listings of above four-bedroom properties on community housing prices. Simultaneously, H-L clusters are more common, indicating that the influence of above four-bedroom Airbnb listings on housing transaction prices in Greater Manchester is rather dispersed, with only a few cluster communities generating a considerable housing price premium. There is a single neighbourhood close to a park in Salford where the influence on housing transaction prices exceeds the average by 4 standard deviations. Additionally, 2 other neighbourhoods show an influence that surpasses the average by 2-4 standard deviations. Nevertheless, for the vast majority of areas in Greater Manchester, the penetration of above four-bedroom Airbnb listings in communities has only a minor influence on housing transaction prices. Calculations show that in 2.75% of communities in Greater Manchester, a substantial positive effect on housing transaction prices can be attributed to the penetration of above four-bedroom Airbnb listings. This circumstance is primarily related to the limited supply and demand for larger properties.

Several small clusters within Manchester form areas of low or negative impacts. It suggests that Airbnb listings of above four-bedroom properties have moved into some of Manchester's less optimal residences, potentially altering the residential environment. Among these, 10 communities display an influence on housing transaction prices that is lower than the average by 8 standard deviations, most of which are located within the city of Manchester. Furthermore, it was found that 19 communities primarily located on the outskirts or suburban areas demonstrate an impact that is below the average by 4-8 standard deviations. These areas experience high levels of penetration from above four-bedroom Airbnb listings, causing significant disturbances to neighbourhoods. Approximately 2.63% of communities in Greater Manchester face a negative impact on housing transaction prices owing to above four-bedroom properties being misused as Airbnb listings. These communities are not traditionally affluent areas. The effect has been exacerbated by lax regulations leading to frequent security problems, thus reducing the quality of life for local residents.

3) In Bristol, due to the limited sample of above four-bedroom Airbnb properties, the impact of above four-bedroom Airbnb on neighbourhood housing prices only exhibits a weak negative impact in a few neighbourhoods. This pattern is characterised by universally weak impacts in most areas of Bristol, with just some H-L clusters in a couple quiet suburban towns.

The areas with a high premium have a dispersed H-L cluster. One is Eastville, located in the northeast of the city, and the other is a few neighbourhoods on the south bank of the river Avon. These neighbourhoods have a beautiful environment

and are close to the Manchester city centre, making these large-sized properties ideal choices for Airbnb investment. It is noteworthy that only 2 neighbourhoods have a premium rate on house prices due to above four-bedroom Airbnb that exceeds the average by 2 standard deviations, and their locations are close to the moderate-value areas in the north of Shirehampton and Sea Mills. There are no other neighbourhoods with a high impact, indicating that Airbnb's penetration of above four-bedroom properties does not significantly raise house prices.

The L-L cluster is mainly concentrated in some neighbourhoods 1.5 km north of the city centre. This is a relatively middle-class area in Manchester, with many students. These characteristics determine that the above four-bedroom type of Airbnb has a limited impact on local house prices. There are 6 neighbourhoods where the premium rate of above four-bedroom type Airbnb on neighbourhood house prices is below the average by 2-4 standard deviations, showing that the large-sized properties occupied by Airbnb only have a slight negative impact on house prices in a few neighbourhoods, and these areas happen to be only civilian middle-class neighbourhoods, with a tendency towards a stable community environment. This shows that the above four-bedroom type of Airbnb also has a limited negative externality on the local community.

7.2.3.5 Summary for different bedrooms of Airbnb properties

The impact patterns of Airbnb on house prices, regardless of the property type, are generally similar in the three cities, and basically follow the core-periphery pattern of high in the centre and low in the edge (Mahmuda et al., 2022). However, the impact size of different property types varies in specific neighbourhoods. This can be regarded as the main distribution feature of Airbnb's impact on house prices. The city centre has rich tourism resources and high accommodation demand, while the suburbs rely on Airbnb to attract tourists, and thus have a more direct impact on neighbourhood house prices. Therefore, this clustering effect is more obvious in small-size Airbnb properties (Rabiei-Dastjerdi, McArdle, & Hynes, 2022).

Of course, the correlation between the impacts of different property types of Airbnb on house prices in each city is mainly affected by the resident composition and the spatial distribution of different property types. Medium and small units (1-3 bedrooms) of Airbnb tend to have a more clustered and zonal positive impact on the suburbs, while among them, although the impact of two-bedroom Airbnb is more concentrated in the suburbs, it also tends to have larger valley in the city centre (Calder-Wang, 2019). This trend is more evident in Greater Manchester and Bristol. For these cities that are relatively lacking in tourists and outsiders, it may even have a negative impact on the house prices in the central area. Larger units (4+ bedrooms) of Airbnb show more clustered impacts, focusing on some

neighbourhoods, which have similar patterns in different cities, but with different degrees of impact.

Broadly speaking, the reproduction of space by Airbnb possesses differential impacts on neighbourhood house prices, contingent on the city, type and size of housing. Dwellings with one to three bedrooms on Airbnb have a pronounced effect, whereas those with more than four bedrooms exhibit a relatively subdued impact (Cheung & Yiu, 2022). In comparison, the escalation of prices in city centres is primarily triggered by the presence of one and three-bedroom properties on Airbnb. Conversely, accommodations containing two or more than four bedrooms might be more predisposed to exert a promoting effect in suburban areas. From this perspective, the proliferation of small-scale Airbnb units could create a greater barrier for long-term residents and contribute to the gentrification of neighbourhoods (Benítez-Aurioles & Tussyadiah, 2021). On the other hand, large-scale Airbnb units could have a negative impact on the social cohesion and stability of local communities.

7.3 Unpacking the impact of long-term occupied Airbnb on residential mobility

In the era of globalisation, the swift advancement of digital technologies and finance has facilitated the worldwide expansion of Airbnb. This remarkable growth, particularly evident in major cities, has exerted significant pressure on the social fabric of these urban environments (Tejedor Galindo, 2020). The transformation of neighbourhoods, driven by technology's ability to capitalise on underutilised assets, has given rise to critical issues such as housing shortages, gentrification, and displacement (Mermet, 2022). The analysis, as detailed in preceding sections, has established a credible link between long-term occupied Airbnb and the dynamics of housing prices. This fluctuation within the housing market, coupled with shifting socio-economic conditions, mirrors the urban process of gentrification induced by Airbnb. Such gentrification can precipitate alterations in the social fabric of a community. These implications hold significant relevance for housing policies and developmental initiatives. In this regard, it is important to understand the relationship between housing prices fluctuation caused by Airbnb and residential churn, especially in deprived areas. This section will delineate a typology of gentrification and the degree of neighbourhood churn, with a specific focus on deprived areas.

7.3.1 Gentrification typology and neighbourhood churn degrees

Having delineated the distinct pen portraits of the gentrification typologies in the methodology, the attention shifts towards a comprehensive analysis with the intricate neighbourhood churn. This analytical phase aims to paint a picture of how residential mobility patterns are inherent across various types of gentrified

neighbourhoods. Commencing with a descriptive analysis, the proportion of households undergone change and each type of gentrification is examined. Subsequently, several statistical tests were carried out for two classifications. The outcomes are summarised in Table 7-7 and Figure 7-13, providing insightful illumination into the interplay between the two identified typologies.

Table 7-7 Measure of association between gentrification typology and neighbourhood churn degree.

Study Area	Chi-squared	Cramer's V	DF	Fisher's p	N
All	292.227	0.093	30	< .001	6771
Greater London	166.125	0.083	30	< .001	4835
Greater Manchester	236.110	0.168	25	< .001	1673
Bristol	24.665	0.177	9	0.008	263

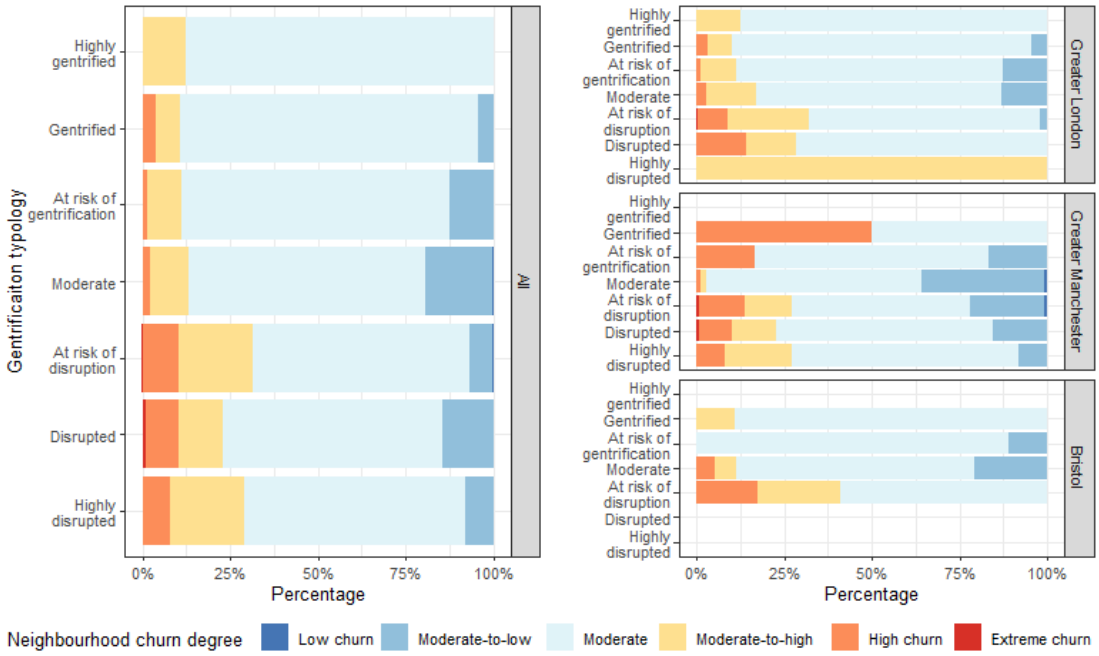


Figure 7-13 Stacked bar plot of churn degree proportions for each gentrification type across all cities and individually in each city. (Own elaboration)

Fisher's exact test uncovers a significant association between neighbourhood gentrification and churn rates. From the stacked bar plot for all three cities, all types of gentrification neighbourhoods are predominantly occupied by moderate levels of churning. A closer examination reveals that highly gentrified neighbourhoods comprise 12.5% moderate-to-high churn neighbourhoods. This trend extends across various categories of gentrification, including those at risk or moderate levels, with a slightly elevated incidence of high churn in areas already gentrified. Meanwhile, from the moderate to highly gentrified neighbourhoods, the proportion of moderate-to-low churn neighbourhoods gets lower and entirely disappears in highly gentrified zones. That means when the premium in housing

prices driven by factors like Airbnb getting higher, there is a greater propensity to induce higher turnover in comparatively more stable neighbourhoods (Arias-Sans, Quaglieri-Domínguez, & Russo, 2022).

On the other hand, extremely high churn rates are less common in disrupted or at risk of disruption though, these neighbourhoods plus highly disrupted have a higher percentage of above-average churn neighbourhoods ranging from 22%-31%, which surpasses that observed in gentrified types of neighbourhoods. The disruptive influence of platforms like Airbnb can be implicated in altering the fabric of neighbourhoods, potentially devaluing properties and fostering environments where residents frequently transition in and out. Notably, areas either at risk of or experiencing high levels of disruption display a reduced presence of low-turnover communities (6.5%-7.9%), with the exception of those categorised as disrupted (14.5%). Disruptions tend to happen in highly transient neighbourhoods, but it may also intrude some steady communities.

In summary, an analysis of churn rates across various types of Airbnb-induced gentrifications in different cities reveals a clear pattern: residential mobility is increasingly prevalent in neighbourhoods experiencing high levels of Airbnb triggered gentrification or disruption (Ardura Urquiaga, Lorente-Riverola, & Ruiz Sanchez, 2020). This is substantiated by average churn rates presented in Table 7-8, highlighting a critical aspect of urban change and its impact on community stability and dynamics.

Table 7-8 Descriptive statistics of churn rates in each neighbourhood type of gentrification.

Area	Gentrification typology	Proportion of households that are changed							
		P0	P25	P50	P75	P100	Mean	SD	N
All	Highly disrupted	0.189	0.285	0.362	0.416	0.636	0.366	0.105	38
	Disrupted	0.165	0.264	0.320	0.402	0.750	0.342	0.112	117
	At risk of disruption	0.111	0.316	0.369	0.422	0.703	0.373	0.097	558
	Moderate	0.095	0.238	0.301	0.370	0.787	0.307	0.092	5216
	At risk of gentrification	0.133	0.260	0.315	0.368	0.629	0.315	0.078	618
	Gentrified	0.158	0.273	0.324	0.367	0.633	0.330	0.078	216
	Highly gentrified	0.275	0.293	0.333	0.367	0.415	0.335	0.050	8
Greater London	Highly disrupted	0.428	0.428	0.428	0.428	0.428	0.428	—	1

	Disrupted	0.287	0.295	0.361	0.404	0.575	0.374	0.102	7
	At risk of disruption	0.183	0.332	0.374	0.422	0.703	0.383	0.082	409
	Moderate	0.109	0.264	0.325	0.386	0.787	0.326	0.090	3632
	At risk of gentrification	0.133	0.261	0.316	0.368	0.583	0.315	0.077	573
	Gentrified	0.158	0.273	0.323	0.366	0.633	0.329	0.077	205
	Highly gentrified	0.275	0.293	0.333	0.367	0.415	0.335	0.050	8
Greater Mancheste r	Highly disrupted	0.189	0.285	0.359	0.414	0.636	0.364	0.106	37
	Disrupted	0.165	0.263	0.318	0.401	0.750	0.340	0.113	110
	At risk of disruption	0.111	0.232	0.332	0.414	0.692	0.338	0.129	132
	Moderate	0.095	0.200	0.246	0.299	0.731	0.255	0.078	1374
	At risk of gentrification	0.155	0.243	0.292	0.364	0.629	0.327	0.129	18
	Gentrified	0.362	0.426	0.491	0.555	0.620	0.491	0.182	2
	Highly gentrified	—	—	—	—	—	—	—	0
Bristol	Highly disrupted	—	—	—	—	—	—	—	0
	Disrupted	—	—	—	—	—	—	—	0
	At risk of disruption	0.222	0.316	0.385	0.477	0.603	0.397	0.103	17
	Moderate	0.140	0.235	0.285	0.377	0.631	0.306	0.100	210
	At risk of gentrification	0.158	0.260	0.293	0.344	0.403	0.300	0.062	27
	Gentrified	0.246	0.284	0.336	0.372	0.442	0.332	0.061	9
	Highly gentrified	—	—	—	—	—	—	—	0

Next, the analysis will look into different cities in view of the fact that each city not only differs markedly from the overall sample but also demonstrates significant dissimilarity when compared to one another.

7.3.1.1 Greater London

Fisher's exact test indicates a significant association between neighbourhood gentrification and residential mobility in Greater London. The city presents a unique case, characterised by a higher proportion of moderate-to-high churn neighbourhoods across various gentrification types compared to the general sample. Owing to the fact that most highly gentrified, gentrified and at risk of gentrification neighbourhoods appear in Greater London, they fairly keep the same distribution with the overall.

There is a slightly higher proportion of moderate-to-high churn in neighbourhoods at risk of disruption and high churn in disrupted neighbourhoods, whilst a notable deviation is observed in neighbourhoods facing the risk of disruption and those already disrupted. On top of that, all highly disrupted neighbourhoods in Greater London fall within the moderate-to-high churn category.

This absence of lower churn rates in highly disrupted areas underscores a growing trend: the progression from gentrified to disrupted zones is accompanied by an increase in high and moderate-to-high churn rates. This pattern suggests that disruptions attributed to Airbnb are catalysts for elevated churn levels in the city. This is further evidenced by the fact that both highly gentrified and highly disrupted areas not only elevate churn to at least a moderate level but also exhibit pronounced average residential mobility rates. In the case of highly disrupted neighbourhoods, this mobility is stark, with around 40% of residents experiencing changes.

7.3.1.2 Greater Manchester

Fisher's exact test indicates significant association between neighbourhood gentrification and residential mobility and Cramer's V indicates the association is stronger in Greater Manchester than in Greater London.

In Greater Manchester, none of the neighbourhoods were classified as highly gentrified, but the share of high churn neighbourhoods that transitioned from highly disrupted to gentrified types increased. This implies that Airbnb, by taking more housing units out of the market, can increase the turnover of residents in Greater Manchester, which is different from the case in Greater London. Besides, the proportion of moderate-to-low churn neighbourhoods from moderate to highly disrupted types is decreasing, which means Airbnb-induced disruption can raise the lower limit of residential mobility.

Likewise, average churn rates present an increasing tendency towards gentrified and highly disrupted neighbourhoods in Greater Manchester. In particular, gentrified neighbourhoods had an average churn rate of 49%, meaning that almost half of the households changed since 2011. This was a distinctive feature of Greater Manchester, compared to other cities. Disrupted

neighbourhoods still had slightly higher average churn rates than neighbourhoods at risk of gentrification.

7.3.1.3 Bristol

The impact of Airbnb on neighbourhood gentrification and residential mobility in Bristol is examined using Fisher's test, which also reveals a significant association between the two variables.

However, unlike other cities where Airbnb has caused widespread gentrification and disruption, Bristol has experienced a more confined and moderate effect. None of the neighbourhoods in Bristol were classified as highly gentrified, disrupted or highly disrupted, indicating that Airbnb has not substantially altered the socio-economic and demographic composition of the local communities. The only exception is the type of neighbourhoods that are at risk of disruption, which have a higher proportion of above moderate churn neighbourhoods than the other types. This suggests that Airbnb may have potentially increased the disruptive risk in these neighbourhoods, where residents are more likely to move out due to social conflicts fuelled by the interruption of Airbnb.

Therefore, although most of the neighbourhoods in Bristol are either gentrified to some extent or vulnerable to the influence of Airbnb, there is a clear higher inclination of higher churn rates towards gentrified neighbourhoods. Moreover, the average churn rates in the gentrified and at risk of disruption neighbourhoods in Bristol are higher than those in other cities, implying that Airbnb may have a more pronounced effect on residential mobility in certain neighbourhoods of Bristol.

7.3.2 Airbnb gentrification roles: A closer look at churn in deprived neighbourhoods

The phenomenon of short-term rentals contributing to neighbourhood disruption and the gentrification of housing resources has been well documented (Robertson, Oliver, & Nost, 2020; Wachsmuth & Weisler, 2018; Nieuwland & van Melik, 2018). However, there remains a significant gap in the literature concerning how this process unfolds in different types of neighbourhoods, especially those that are already marginalised and deprived. This section aims to fill this gap by conducting a comparative analysis of the spatial patterns and dynamics of Airbnb-induced gentrification in three major UK cities.

The investigation begins with the application of descriptive statistics to present an overview of the 20% most-deprived, 20% least-deprived, as well as the remaining neighbourhoods within various Airbnb-induced gentrification types. To enhance the understanding of the churn phenomenon within impoverished communities, the study was further enriched by spatial analysis methods, focusing

specifically on the 20% most deprived areas within each city and examining their demographic, socioeconomic, and housing characteristics in these neighbourhoods. These approaches enable us to explore the specific dynamics of Airbnb-induced gentrification in neighbourhoods with different levels of deprivation.

Table 7-9 Churn rates across deprivation levels within various gentrification typologies.

Gentrification typology	Deprivation	Proportion of households that are changed				
		Median	Mean	SD	Range	N
Highly disrupted	20% most-deprived	0.371	0.376	0.062	0.214	22
	Remaining neighbourhoods	0.322	0.373	0.144	0.442	14
	20% least-deprived	0.200	0.200	0.015	0.021	2
Disrupted	20% most-deprived	0.348	0.362 *	0.075	0.330	50
	Remaining neighbourhoods	0.287	0.336	0.133	0.585	62
	20% least-deprived	0.209	0.214	0.043	0.109	5
At risk of disruption	20% most-deprived	0.371	0.384 ***	0.079	0.375	110
	Remaining neighbourhoods	0.374	0.381	0.099	0.592	384
	20% least-deprived	0.307	0.304	0.090	0.430	64
Moderate	20% most-deprived	0.317	0.327 ***	0.074	0.440	1189
	Remaining neighbourhoods	0.308	0.315	0.093	0.692	3319
	20% least-deprived	0.210	0.233	0.081	0.480	708
At risk of gentrification	20% most-deprived	0.342	0.344 ***	0.066	0.353	111
	Remaining neighbourhoods	0.317	0.320	0.075	0.474	439

	20% least-deprived	0.225	0.232	0.063	0.260	68
Gentrified	20% most-deprived	0.358	0.369***	0.081	0.377	26
	Remaining neighbourhoods	0.324	0.332	0.075	0.462	174
	20% least-deprived	0.242	0.252	0.052	0.199	16
Highly gentrified	20% most-deprived	—	—	—	—	0
	Remaining neighbourhoods	0.333	0.335	0.050	0.140	8
	20% least-deprived	—	—	—	—	0

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, measured using one-way ANOVA.

The Table 7-9 presents the descriptive statistics of the churn rates for the three deprivation groups of neighbourhoods within each gentrification type.

A significant difference was observed between the three deprivation groups of neighbourhoods for most gentrification types except highly disrupted and the fact that it is unable to find any highly gentrified neighbourhoods are well 20% most deprived or 20% least deprived in the three cities, suggesting that Airbnb has not caused extreme gentrification in these areas. In most gentrification types, the churn rates in 20% most deprived neighbourhoods are higher than those in 20% least deprived and remaining neighbourhoods, indicating that Airbnb-induced gentrification has a stronger effect on residential mobility in impoverished areas.

Unlike other gentrification types having most remaining neighbourhoods, highly disruptive neighbourhoods have 22 LSOAs within 20% most deprived neighbourhoods, more than the 14 remaining neighbourhoods. The lower than 95% significance might be because average churn rates of most deprived neighbourhoods are close to remaining neighbourhoods, but 20% most deprived neighbourhoods still show slightly higher median and mean churn rates.

In the disrupted neighbourhoods, the difference between 20% most deprived neighbourhoods becomes significant from the rest two groups, but it can be seen that the average churn degree is lower than that in highly disrupted neighbourhoods.

Neighbourhoods at risk of disruption have fairly significant differences between deprivation groups and the 20% most deprived group happen to have the highest churn rates than any other types of neighbourhoods. This could mean when short-term rentals show signs of disturbing the neighbourhood, they begin to cause residence instability in deprived neighbourhoods.

The difference between deprivation groups in gentrified neighbourhoods is also quite significant and the mean churn rate of the 20% most deprived group is 36.9% which is second only to the level of highly disrupted neighbourhoods.

Within neighbourhoods at risk of gentrification, there is a significant difference between 20% most deprived, 20% least deprived and remaining neighbourhoods in terms of residential mobility. In comparison to the average churn of 20% most deprived group with that in gentrified and moderate neighbourhoods, the level is in the middle, which suggests these neighbourhoods are more stable and less exposed to Airbnb gentrification forces and validates a trend of higher community turnover in deprived areas towards more Airbnb gentrified areas.

To sum up, there are significant differences in the mean churn rates across the deprivation levels within each gentrification typology. Airbnb tends to stir up residency in more gentrified areas especially those deprived areas. There is also a trend of making more housing mobility when more disruptions brought by Airbnb to devalue the neighbourhood, but evidence shows a stronger residential churning in deprived neighbourhoods at risk of Airbnb's disruption.

7.3.2.1 Airbnb gentrification and churning in deprived neighbourhoods

The spatial overlay analytical approaches enable us to gain a closer insight into how Airbnb gentrification and residential mobility interact in 20% most deprived neighbourhoods. The focus will be placed on the spatial distribution of two ways of Airbnb-induced gentrification and pay particular attention to above moderate churning areas so as to identify the relationship between Airbnb and potential displacement within certain neighbourhoods under deprivation in each city. The moderate type of gentrification is excluded from the analysis, as it has a less pronounced effect on the deprived areas and would complicate the interpretation of the results.

7.3.2.1.1 Greater London

Figure 7-14 displays the gentrified and disrupted neighbourhoods separately in Greater London. High or moderate-to-high churn areas are outlined using solid or dashed lines from which the specific deprived neighbourhoods can be scrutinised.

There are 6 high churn areas around Greater London city centre, among which 4 of them are in Hackney, 1 in Newham, so most of them are in East London and the rest one is in Southward, situated southeast of the South Bank area. These neighbourhoods have good locations which can easily access to various tourist attractions and amenities, which are suitable for Airbnb occupancy. Besides, these areas mainly consist of flat type properties, and this type of properties can be easily transformed to Airbnb use and home sharing can spoil the living atmosphere. All of these neighbourhoods are at risk of Airbnb disruption, so probably when Airbnb

starts to penetrate some deprived central neighbourhoods, it will make more housing rotation, as found from previous analysis. Furthermore, 16 neighbourhoods at risk of disruption, mostly located in Inner London and 1 highly disrupted neighbourhood in Redbridge, at the same time, have moderate-to-high churn. Tower Hamlets is the one local authority has the most of these neighbourhoods. These deprived neighbourhoods have lower property prices, and this makes them attractive to property owners looking to generate additional income through short-term rentals like Airbnb.

Airbnb gentrified neighbourhoods present different spatial distribution where most of them are not in Central London. There are 4 high churn areas in East London suburbs, among which 2 of them are in Barking and Dagenham, 1 in Hackney and the 1 in Greenwich. These neighbourhoods either lack access to services or hold large public housing estates, where Airbnb taking dwellings can push up property prices, displace population and gentrify the area in a new form. Moreover, 15 neighbourhoods at risk of gentrification and 2 gentrified neighbourhoods have moderate-to-high churn. Their spatial distributions are scattered in North, East and South, and only 3 neighbourhoods in Newham are recognised as a cluster. These deprived neighbourhoods have been declining, and vacant or underutilised houses have been put onto Airbnb.

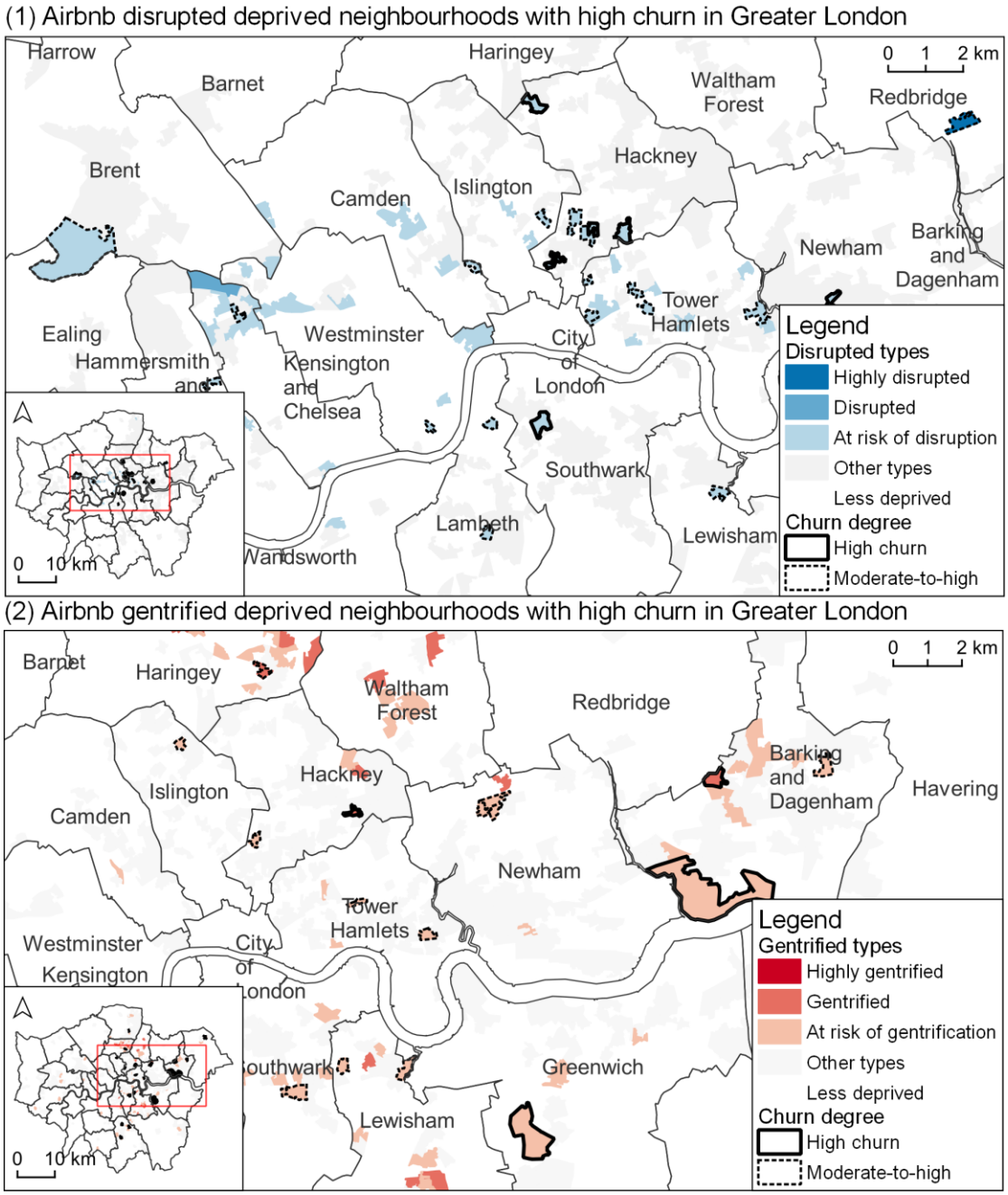


Figure 7-14 The Airbnb disrupted or gentrified areas with Moderate-to-high churn in 20% most deprived neighbourhoods in Greater London. (Own elaboration)

7.3.2.1.2 Greater Manchester

Figure 7-15 displays the disrupted and gentrified neighbourhoods separately with churn degree in Greater Manchester. In comparison to Greater London, more disrupted neighbourhoods with moderate-to-high churn are concentrated in Manchester city centre and less gentrified neighbourhoods are around there.

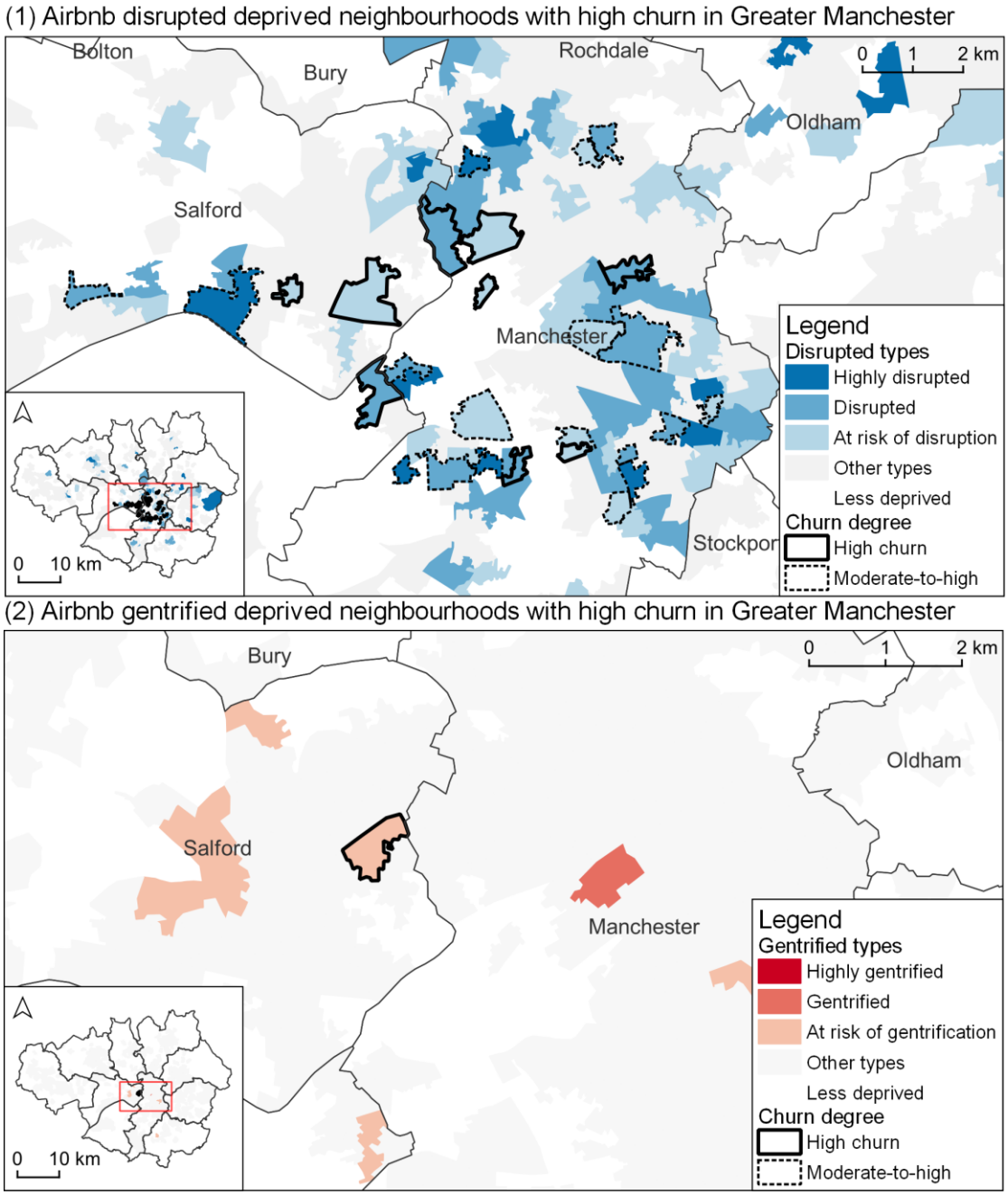


Figure 7-15 The Airbnb disrupted or gentrified areas with Moderate-to-high churn in 20% most deprived neighbourhoods in Greater Manchester. (Own elaboration)

There are 9 high churn areas around Manchester city centre, among which 4 of them are disrupted and 5 are at risk of disruption, situated southeast of the South Bank area. These neighbourhoods are located just within a 4km radius of the city centre, and the good location can easily get transport and travel to the city centre.

These areas have a diverse population, including younger residents or students, making them particularly conducive to the establishment of Airbnb rentals, as they can cater to a broad and varied clientele and as a result high churn. The diverse population in these areas, including both younger mixed residents and students, renders them highly suitable for the transformation to Airbnb rentals.

Their ability to cater to a broad and varied population also contributes to significant turnover or churn in neighbourhoods. Furthermore, 5 highly disrupted, 7 disrupted and 6 neighbourhoods at risk of disruption have moderate-to-high churn. Most of them are situated in the east and south side of the city centre such as Bradford, Moss Side and Hulme. These areas have historically faced various challenges such as high poverty rates, limited opportunities, and lack of resources. Although urban regeneration and transformation projects aimed to improve living conditions and the attractiveness of these areas, they have also created unintended consequences. Some residents may choose to leave their home and list their houses and flats on Airbnb as an additional source of income, while others may be forced to move out due to the pressure of the market. This process leads to a high churn rate in these areas, which reflects the instability and vulnerability of the local communities.

Airbnb gentrified neighbourhoods are minor in Greater Manchester. There is only 1 neighbourhood at risk of gentrification with moderate-to-high churn in Salford, which could be partly attributed to the presence of Airbnb. This neighbourhood, which was already socio-economically disadvantaged, experienced a significant rotation of households (about 50%) since 2011 when Airbnb was launched and an increase in its crime rate during the same period indicating a deterioration of its living conditions. These trends suggest that Airbnb did not attract affluent newcomers or investors to this neighbourhood, but rather displaced existing residents who could not afford or tolerate the negative externalities of short-term rentals.

7.3.2.1.3 Bristol

Figure 7-16 displays the spatial distribution of disrupted and gentrified neighbourhoods in Bristol, along with their respective churn degrees. In comparison to the other two bigger cities which have larger and more dispersed areas of disruption or gentrification, Bristol shows a more concentrated pattern of neighbourhood change around the city centre. A few disrupted or gentrified neighbourhoods with moderate-to-high churn near the city centre might have undergone transformation of their social and physical fabric.

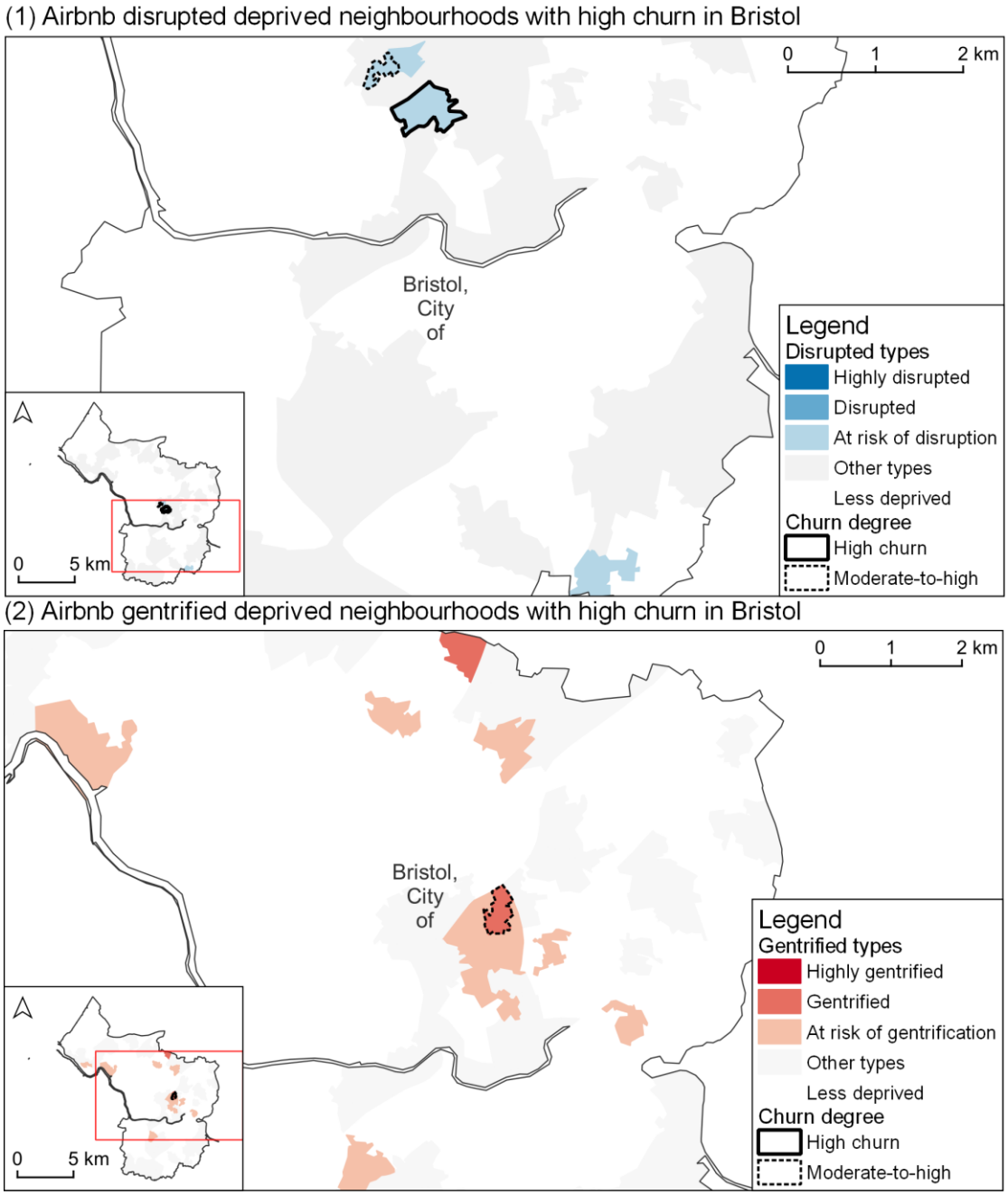


Figure 7-16 The Airbnb disrupted or gentrified areas with Moderate-to-high churn in 20% most deprived neighbourhoods in Bristol. (Own elaboration)

There is 1 high churn and 1 moderate-to-high churn area around Bristol city centre. The area at risk of disruption with high churn is close to Old Market that once thrived as a commercial and cultural hub, but it faced neglect and decline in recent years due to changes in Bristol's shopping areas. As a result, many buildings in this area have become vacant or underused, creating opportunities for Airbnb to take these low-cost housing. However, the churn rate in this area was 50.6%, well above the city average of the type of 39.7%. This also means that the area suffers from a high churn rate, as residents tend to move out after a short period of time, either voluntarily or involuntarily.

Airbnb presence had a limited extent on gentrifying neighbourhoods. There is only 1 gentrified neighbourhood with moderate-to-high churn in Easton around Stapleton Road. Despite the inner city area located just east of Bristol city centre and diverse housing, it is not an affluent area but severely deprived, ranking among the highest 10% in the country in terms of unemployment and crime. The data shows that the churn rate in this area was 44.2%, slightly above the city average. Large immigrant populations, increasing housing cost, and limited rental offer contribute to the gentrification of this neighbourhood through Airbnb.

7.4 Summary and Conclusion

This chapter analysed the heterogeneous impact of different types and bedroom counts of Airbnb on housing prices and the relationship between Airbnb-induced gentrification and residential churn across neighbourhoods in three major British cities. Neighbourhoods with better environmental and amenity improvements tend to have higher premiums generated by Airbnb (Vizek, Barbić, & Časni, 2024). It also reveals diverse spatial patterns and market characteristics in different regions of England.

The spatial distribution of Airbnb's impact on the house prices of the three cities shows a pattern of weak in centres and strong in suburbs (Todd, Musah, & Cheshire, 2021). This is mainly because the real estate market is more stable in the central areas with limited premium space. In contrast, the housing supply in the suburbs is relatively low and short-term rentals can result in a scarcity effect, making Airbnb's impact on the suburban residential areas relatively large. In addition, attracting outsiders by using vacant houses can stimulate the vitality of the suburban housing market (Paccoud & Mace, 2018), and may increase the attractiveness and value of the area to tourists and visitors, which may further increase house prices in the long run.

For both flat and house types of properties, the impact is more pronounced in the suburbs than in the city centre, but house-type Airbnb properties tend to have a greater impact on some suburban neighbourhoods than flat-type (Shabrina, Arcaute, & Batty, 2021), a trend that is especially evident in Greater London and Bristol. On the other hand, flat-type Airbnb properties have a positive impact on the city centre of Greater London and Bristol, but a negative one in Manchester (Cheung & Yiu, 2023). The affordable suburban housing makes it an attractive investment target for Airbnb rentals, especially for house-type properties.

In terms of property sizes, smaller units of Airbnb have a stronger positive impact on the suburbs, which are more concentrated and zoned in certain districts (Thackway et al., 2022). This trend is more evident in Greater Manchester and Bristol with relatively fewer tourists and outsiders. Airbnb with four bedrooms or above have a more confined positive impact in just several suburban neighbourhoods (Chaudhary, 2021). In other words, the surge in small-scale Airbnb

properties may pose greater obstacles to long-term residents and promote the gentrification of the neighbourhood. On the other hand, large Airbnb properties may have a negative impact on the social cohesion and stability of the local community (Shabrina, Arcaute, & Batty, 2021; Cheung & Yiu, 2022). These short-term lettings could significantly alter the features and identity of the community, leading to changes that may not be appreciated or accepted by the existing residents who have to cope with the consequences.

Then a typology of Airbnb gentrification that distinguishes between different levels of disruption and gentrification caused by short-term rentals in deprived neighbourhoods was proposed. It shows that Airbnb gentrification is associated with increased residential mobility, especially in central areas that are undergoing rapid socio-economic transformations and face high displacement pressure. These areas experience high turnover rates of lower-income residents who are forced to move out due to the influx of tourists and the loss of affordable housing. Other European cities like Amsterdam (Tejedor Galindo, 2020) and Barcelona (Valente et al., 2023) also suffer from the same problem. On the other hand, gentrification in peripheral areas is more gradual, but still erodes the housing opportunities for poorer households (Ardura Urquiaga, Lorente-Riverola, & Ruiz Sanchez, 2020).

Another finding is that the level of deprivation of a neighbourhood is positively correlated with its churn rate, indicating that deprivation makes households more vulnerable to displacement and mobility (Adamiak & Marjavaara, 2023; Wang et al., 2023). When Airbnb enters some deprived central areas, it creates more housing instability and insecurity for the surrounding residents.

The analysis demonstrates that Airbnb-induced gentrification is not a homogeneous process, but rather a complex and context-specific one that varies across and within cities. By using a spatial perspective and a comparative approach, it offers a refined understanding of how Airbnb affects the socio-economic dynamics of deprived neighbourhoods.

CHAPTER 8
PEER-TO-PEER ACCOMMODATION MARKET RESPONSES DURING COVID-19 PANDEMIC: WAS THE DISRUPTOR DISRUPTED?

8.1 Introduction

Short-term rentals and their associated platform technologies are understood to be having a transformative effect on urban housing markets globally (Deboosere et al., 2019). Here notable attention has been paid to the 'disruptive potential' of Airbnb and other platform services on the urban economy, especially on tourism and the housing market. However, at the start of 2020, the novel coronavirus (COVID-19) swept across the world, with countries imposing restrictions on the international movement of people: borders, hotels, restaurants and tourist attractions were closed or became highly restricted (Gerwe, 2021). This halted the 'normal' functioning of cities, challenged the multidimensional links between cities, paralysed the travel and tourism industries, and led to recession in urban economies internationally, including in the accommodation sector (Zachreson et al., 2021). The unexpected shock of COVID-19 on global urban economies led some commentators to ask whether COVID-19 had served to 'disrupt the disruptor' (Dolnicar & Zare, 2020, p. 1).

Yet little is known about how the COVID-19 shock to short-term rentals 'landed' across space and over time, a gap this chapter aims to address. First, if prior to the pandemic short-term rentals were concentrated in certain types of neighbourhoods, close to tourist attractions (Jang & Kim, 2022), were deepening housing market inequalities and facilitating gentrification (Wachsmuth & Weisler, 2018; Deboosere et al., 2019; Lima, 2019; Morales-Pérez, Garay, & Wilson, 2020), then comprehending differential patterns of change in short-term rentals in response to crisis could better understand the geographically specific vulnerability of certain neighbourhoods to shocks (Wachsmuth & Weisler, 2018). Second, different types of hosts may double-down and seek to weather the storm while others may re-calculate their risk and adjust their hosting strategy. A crisis could reproduce inequalities in access to housing information as a new spatial divide, triggering spatial adjustments in short-term rental patterns, which may have implications for urban housing systems and regulation (Wachsmuth & Weisler, 2018; Dolnicar & Zare, 2020).

Against this context, this chapter focuses exclusively on Greater London to avoid potential inconsistencies due to different local restriction tiers in

Manchester and Bristol (GOV.UK, 2021). The Airbnb market in Greater London exhibits distinctive vibrancy and complexity compared to other urban areas. The capital's status as a global city is reflected in its high density of Airbnb accommodations. This characteristic makes it particularly susceptible to shifts in international travel patterns induced by the pandemic, thereby positioning it as a pivotal case study for analysing the P2P accommodation market amid a pandemic crisis.

The contribution of this chapter lies in its exploration of how the Airbnb market responded to the COVID-19 pandemic in Greater London through an analysis of Airbnb listings, revenues, and spatio-temporal characteristics. In doing so, a geospatial framework was employed to identify those neighbourhoods that experienced the most notable changes in Airbnb listings and yields during different phases of the pandemic and assess the factors that influenced Airbnb listings across Greater London. Here questions around the analysis were framed in the following:

1) To what extent have Airbnb rentals been affected before, during and after the pandemic across space and over time?

2) Did Airbnb rental revenues vary during the pandemic based on location, amenities, and host neighbourhood characteristics? If so, how?

3) Is there any association between Airbnb rental revenues and neighbourhood level deprivation and is there evidence of Airbnb rental revenues clustering spatially across Greater London during different phases of the pandemic?

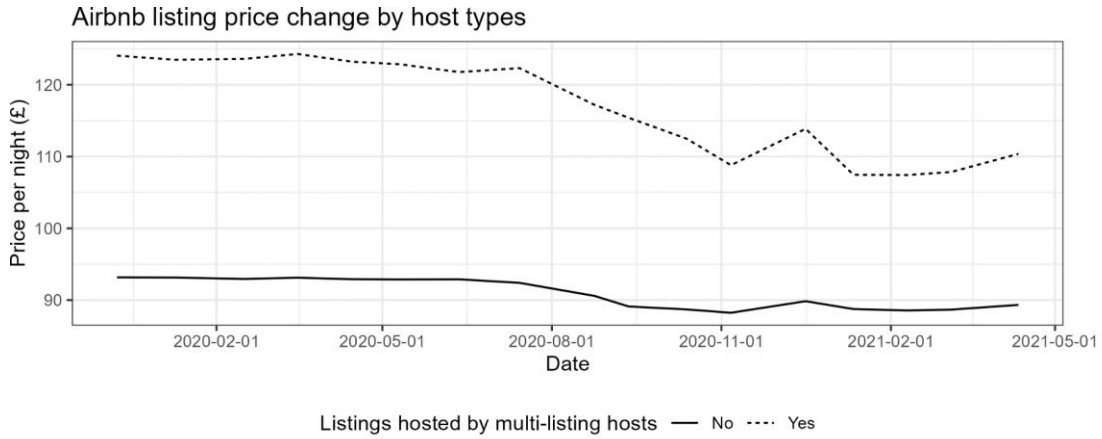
8.2 Airbnb, short-term rentals and the COVID-19 crisis

Airbnb is now a firm fixture of the sharing economy, whose nature has become increasingly complex over time (Wang et al., 2023). Conceived originally as a means for the small-scale 'amateur landlord' to advertise and share spare rooms and second homes to generate income, critics point to a gradual deviation towards large-scale, entrepreneur-led activities (Gil & Sequera, 2020; Balampanidis et al., 2021; Todd, Musah, & Cheshire, 2021; Bosma & van Doorn, 2022), as profit-making opportunities are said to be attracting rising numbers of professionals – reflected in multi-listing and 'super-host' providers (see Deboosere et al., 2019) – advertising on the platform with large-scale investors and management companies increasingly involved in the short-term rental sector (Agustín Cocola-Gant et al., 2021; Semi & Tonetta, 2021).

While advocates of Airbnb point to the ways the platform promotes and supports business and visitor economies, especially in non-traditional tourism locations (Eugenio-Martin, Cazorla-Artiles, & González-Martel, 2019, p. 1240), critics contend that Airbnb exemplifies an aspect of the sharing economy that is increasingly co-opted into 'platform capitalism', where digital technology and lean platforms enable profit to be extracted, in the case of Airbnb, through housing as

an 'asset' (Gurran & Shrestha, 2021). Through this critical lens, short-term rentals, underpinned by digital platforms, remain predominantly located in the vicinity of established tourist attractions and work to channel investment into the residential property sector, acting to deepen the financialisation of housing and the storing of capital investment in the built environment through a 'hyper-flexible' rental market (Wachsmuth & Weisler, 2018; Gutiérrez et al., 2017). The risk here is that P2P platforms simply serve to intensify the spatial clustering of tourism-related accommodation in certain neighbourhoods that deepen and extend existing geographies of housing insecurity that includes the displacement of local residents.

Set against this context, Airbnb is muted as a highly flexible P2P platform though it did not escape the impacts of the unprecedented global pandemic. In May 2020, Airbnb Inc. made 1,900 employees redundant, approximately 25% of its workforce, and projected revenue was halved compared to 2019 (Gerwe, 2021). Yet evidence also revealed that Airbnb hosts lost 6.5 times more than the platform itself (Chen et al., 2021), suggesting hosts bore greater pandemic risks. In seeking to mitigate impacts in the early stages of the pandemic, evidence suggests that professionals offered larger discounts (Figure 8-1) and more adeptly adjusted prices to maximise earnings (Hu & Lee, 2020). Yet all types of hosts saw falling occupancy internationally, especially professional ones. Some hosts found alternative ways to move their properties out of short-term lettings and convert them back to long-term ones (Nhamo, Dube, & Chikodzi, 2020; Calatayud, 2020).



Data source: Inside Airbnb

Figure 8-1 Average Airbnb listing price change by host types during the outbreak of COVID-19 pandemic in Greater London. (Own elaboration)

Here it is recognised that the impact of the pandemic on short-term rentals is unlikely to be spatially or temporally homogeneous (Jang et al., 2021; Jang & Kim, 2022), with predictions being that short-term rental markets will not return to pre-COVID dynamics, that profit-minded hosts will move their assets to safer longer-term rentals, and amateur hosts will increase their presence on the platform

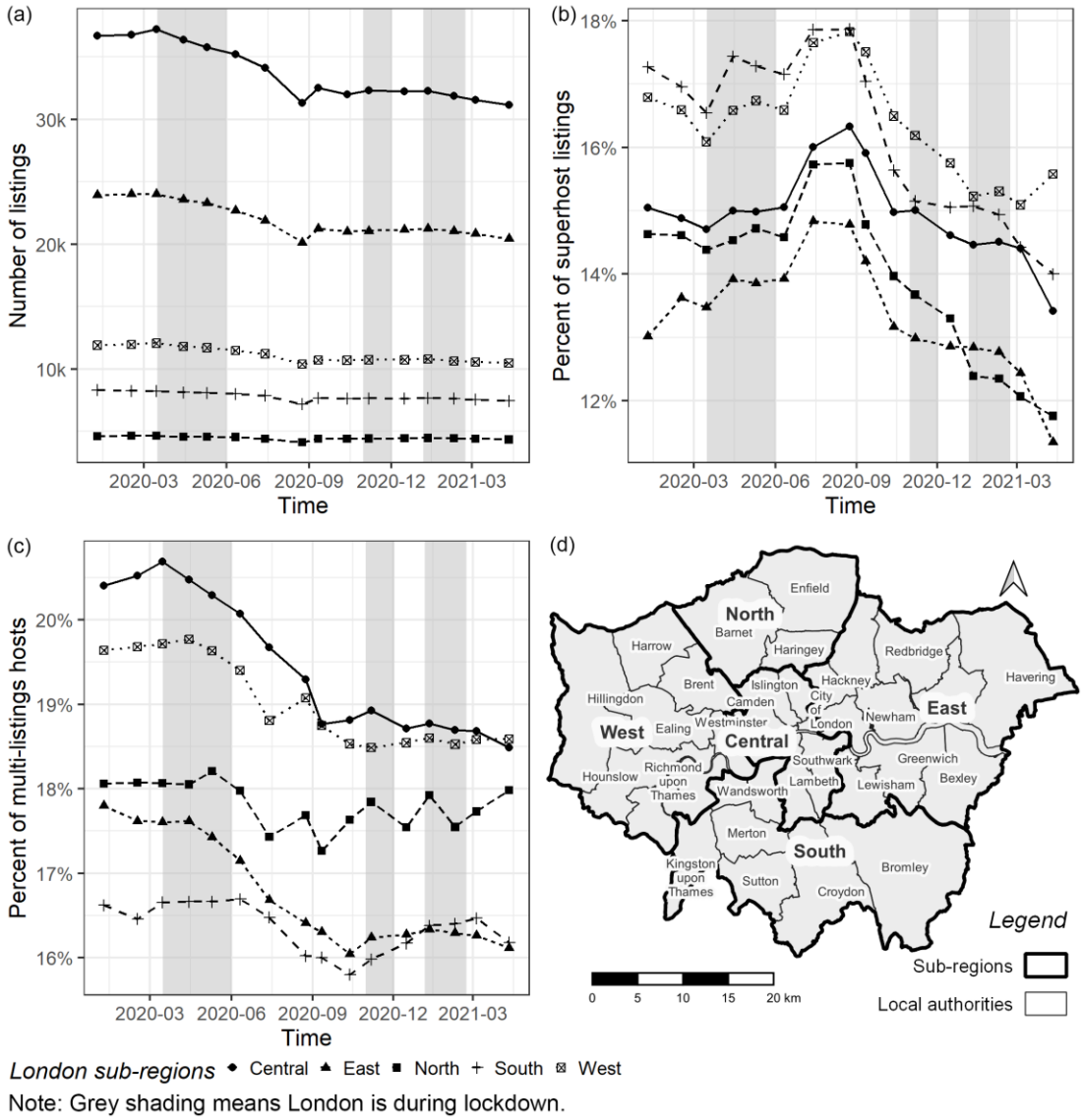
(Dolnicar & Zare, 2020). The extent to which the pandemic has instituted a shift in towards the original ethos of Airbnb remains to be seen. The focus instead falls on elucidating spatial patterns in Airbnb listings and revenues over the course of the pandemic in Greater London, revealing patterns of spatial clustering in Airbnb responses and geographies variegated by levels of neighbourhood deprivation (also see Todd, Musah, & Cheshire, 2021).

8.3 Understanding the disruption of the COVID-19 pandemic to Airbnb revenue

Covering the five 'sub-regions' defined in *The London Plan* (London City Hall, 2016), a time series dataset of listings and their associated characteristics was developed. Generally, over the pandemic period, the number of listings in all sub-regions of Greater London exhibits a downward trend. While the super-host designation[6] is only awarded to approximately 18% of hosts, a notable change in the proportion of super-hosts was seen during the pandemic. At the same time, the Airbnb market in London is primarily comprised of single listing hosts, who account for around 82% of the market but only hold approximately 56% of all listings in the city. However, multi-listing hosts[7], who are often more professionally oriented (see Deboosere et al., 2019), account for around 44% of all listings in the city. This suggests that Airbnb has evolved in London with a certain degree of professionalisation as has been found in other cities internationally (Gil & Sequera, 2020). Yet across the sub-regions of London over the period of the pandemic, there were notable variations in the geography of listings. In the early stages of the spread of the pandemic, from *January 2020 to March 2020,* when England was yet to enter full lockdown, the number of listings held constant, with the number of listings increasing slightly in central London (Figure 8-2). The proportion of listings operated by super-hosts tended downwards in all sub-regions except the East, while multi-listing hosts saw a modest rise in the Central and West sub-regions but decreased in the South and East sub-regions.

[6] Super-hosts are experienced hosts who have consistently received high ratings from their guests. Many super-hosts treat their Airbnb operation as a professional business, delivering professional-level hospitality. They have been associated with a professionalisation of Airbnb (Deboosere et al., 2019).

[7] Multi-listing hosts on Airbnb are hosts who operate multiple listings on the platform, either multiple properties or multiple listings for the same property. Multi-listing hosts are often more professionally oriented and may be looking to generate more revenue through their listings (see Deboosere et al., 2019). Multi-listing hosts are more like micro-entrepreneurs operating traditional rental or hospitality businesses. They can range from owners of several vacation properties to managers of multiple rental units across diverse locations.



Note: Grey shading means London is during lockdown.

Figure 8-2 Changes in the number of Airbnb listings and hosts during the spread of COVID-19 in sub-regions of Greater London. (Own elaboration)

During the first lockdown, from March to June 2020, Central, East and West London hosts responded rapidly to the emerging challenges posed by the pandemic, where the number of listings declined notably. In contrast, South and North London exhibited greater stability in the number of listings. At this time, the proportion of listings for super-hosts increased, with non-super hosts exhibiting the highest decline in adverts number. This suggests that super-hosts were maintaining listings for the sake of business or long-established reputation, while non-superhosts became more concerned about the direction of the deepening COVID crisis. Simultaneously, the proportion of multi-listing hosts began to decline as they either exited from the platform or reduced their property offerings. Following the gradual easing of the initial lockdown, there was a further decline in all regions between June and October 2020, which included a decline in non-super-host and multi-listing hosts. Despite a brief rebound in overall listings

in early September, the number of listings declined significantly after the government announced new restrictions, including limitations on overnight stays and a 10pm curfew in the hospitality sector. These restrictions had a dramatic impact on the number of super-host and multi-listing hosts, and a subsequent reduction in revenue.

With the resurgence of COVID-19, a second lockdown in England was announced on October 31. Despite a rapid increase in the number of confirmed COVID-19 cases during the period between *November and December 2020,* the analysis revealed no significant shift in the number of listings across sub-regions of Greater London. Moreover, the ending of the second lockdown did not result in a notable influx or outflow of hosts from the short-term rental market, but rather a sustained pattern of listings as hosts seemingly adopted a "wait-and-see" strategy. Although the proportion of multi-listing hosts showed some signs of recovery when the lockdown was briefly lifted, this uptick remained relatively minor due to the shorter duration of the second lockdown and its attenuated effects on the market.

A third lockdown was implemented in December 2020 due to the rapid spread of the Delta variant and the continued high level of new confirmed cases and death rates. This lockdown also had an impact on host participation in the short-term rental market in certain sub-regions over the period from *January to April 2021.* However, the magnitude of this impact was diminished in comparison to the first lockdown. A slight decline in the number of listings was observed in Central and East London, areas already characterised by high Airbnb stocks, and a decline in the proportion of multi-listing hosts was noted. In South and North London, sub-regions with already low stocks, experienced a less pronounced decline in the number of multi-listing hosts, which rebounded close to its initial level in the period immediately following the third lockdown. Meanwhile, there was a noteworthy decline in super-hosts across most regions, except for the West sub-region, which had long had a high proportion of both multi-listing and super-host listings.

8.3.1 Spatial patterns of Airbnb revenue during COVID-19 pandemic – a neighbourhood perspective

In the pre-lockdown period, high Airbnb revenue neighbourhoods were concentrated in areas like Westminster, Chelsea in Central London, and surrounding regions known for their established commercial and tourist appeal, characterised by elevated housing costs and incomes (Figure 8-3). Affluent areas on the outskirts of London, including Barnet in the North and Croydon and Bromley in the South, also featured high-yielding Airbnb neighbourhoods. As the first lockdown was lifted, the pattern of high-yielding neighbourhoods concentrated in Central London became less pronounced. Many other inner-city areas recorded

declines in listing numbers comparable to those in Greater London's suburbs. The reduction in high-yielding Airbnb neighbourhoods is likely to reflect the impact of the lockdown on the tourism industry and the corresponding decrease in demand for short-term rentals in inner-city areas.

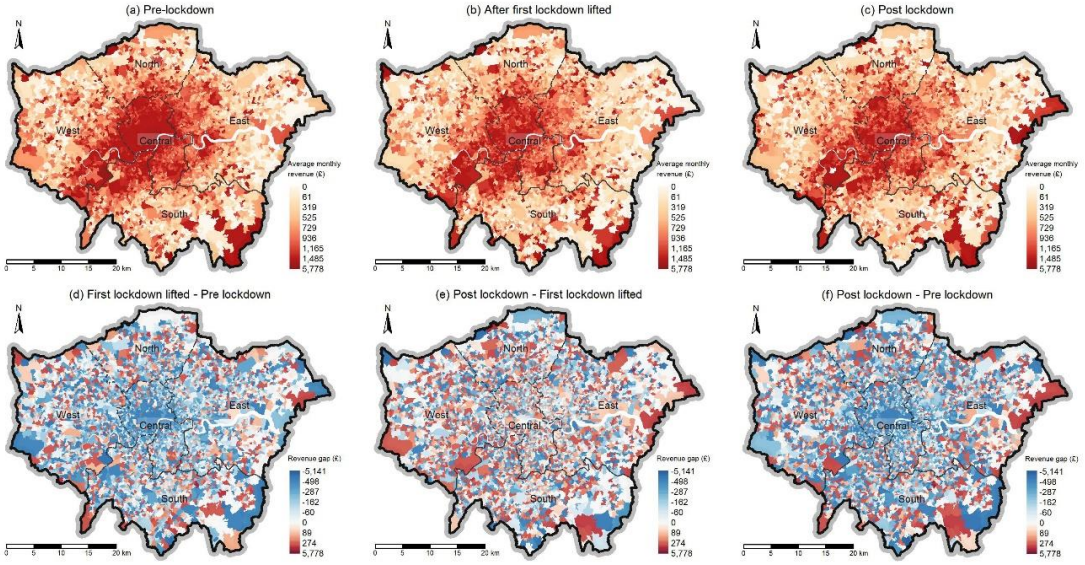


Figure 8-3 Airbnb revenue changes in pre-lockdown, after first lockdown lifted and post lockdown periods. (Own elaboration)

Neighbourhoods with evidently declining yields were those with previously higher yields in the outskirts of Greater London such as Croydon, Bromley, and Richmond-upon-Thames. Similarly, neighbourhoods in Westminster, the City of London, Kensington, Chelsea and Hammersmith and Fulham exhibited a reduction in revenue. Conversely, Havering and Bexley, in East London, had fewer Airbnb listings at the outset of the pandemic and thus experienced less of an impact after the first lockdown. Even when accounting for seasonal variations, the lockdown served to significantly suppress Airbnb revenues.

In the post-lockdown period, the overall spatial distribution of Airbnb revenue closely resembled that of the first two periods, with a recovery in high-yielding neighbourhoods situated at the intersection of Central London and the South West such as Barnet and Richmond-upon-Thames, alongside declines in scattered areas. There was also an indication of high-yielding neighbourhoods dispersing towards suburban areas, where isolated suburban neighbourhoods saw high Airbnb revenues. The impact of the second and third lockdowns on the Airbnb revenue recovery trend appeared to diminish, likely due to varied spatial impacts and changes in lodging location demand after the third lockdown restrictions were lifted.

Despite some revenue suppression, it is nevertheless clear that between the pre-pandemic and post-pandemic periods the general trend was towards stability

or growth in concentrations of Airbnb number and revenue levels across LSOAs in Greater London (Table 8-1). It becomes evident that many neighbourhoods with established Airbnb concentrations before the pandemic remained dominant in the post-pandemic period, with deeply entrenched revenue streams. In this sense, while it seems to be the case that the Airbnb market was disrupted by the COVID-19 pandemic, nevertheless Airbnb remained stubbornly entrenched in existing strongholds, especially those in Inner London.

Table 8-1 Proportion of LSOAs in each state of change from pre-lockdown to post lockdown.

	Cut off by 0.5 standard deviation		**Cut off by 0.25 standard deviation**		**Cut off by 0.125 standard deviation**	
	Revenue gap	Number of listings	Revenue gap	Number of listings	Revenue gap	Number of listings
Increasing	12.60%	4.67%	19.81%	10.32%	25.07%	16.73%
Stable	53.38%	73.92%	32.35%	56.86%	19.63%	41.63%
Decreasing	34.02%	21.41%	47.84%	32.82%	55.31%	41.63%

8.4 Uncovering the effect of neighbourhood characteristics on Airbnb revenue throughout the COVID-19 pandemic

The final dataset contains monthly Airbnb estimated revenue per bedroom and various predictors for the 4835 LSOAs in Greater London, spanning the pre-lockdown, first lockdown lifted, and post-lockdown periods as defined in the methodology. N_PT, No_Resi_Pct, Unemploy_Pct and Qual_Pct were excluded from the final models due to multicollinearity concerns (Table 8-2).

Table 8-2 Descriptive statistics.

Variables	Unique	Obs.	Mean	SD	Min	Median	Max
Average host revenue per bedroom							
Pre_avg_rev_cal	4020	4835	878.07	644.05	0.00	803.42	5700.00
Fst_avg_rev_cal	4002	4835	754.83	568.44	0.00	700.00	5778.00
Post_avg_rev_cal	3946	4835	738.91	565.77	0.00	681.17	5457.00
Structural factors							
Dwe_ModAge	12	4835	1935.64	34.52	1900.00	1935.00	2010.00
OpenSpace_Pct	245	4835	15.99	24.94	0.00	0.00	95.90
Neighbourhood amenities							
Tour_Den	415	4835	0.67	3.19	0.00	0.00	71.79
Leisure_Den	1763	4835	5.48	14.39	0.00	0.00	306.95
Shop_Den	169	4835	0.15	0.99	0.00	0.00	17.15
Accessibility and location							
PTALs	77	4835	3.74	1.60	0.30	3.30	8.00
Dist_CBD	4835	4835	12387.23	5777.05	281.21	12269.97	29955.16
Socio-demographics							

Pop_Den	323	4835	98.69	63.61	1.00	86.00	803.00
Ethnic_Pct	848	4835	39.29	20.35	1.80	36.90	96.50
PriRental_Pct	575	4835	24.08	12.83	1.60	22.60	87.90
Homeworker_Pct	4401	4835	3.34	2.07	0.25	2.78	14.87
Mean_Income	4577	4835	46209.91	16067.95	20110.00	41859.00	140661.00

The global Moran's I test of the neighbourhood Airbnb revenue per bedroom unaffected by pandemic lockdown reveals the presence of spatial autocorrelation at all three time periods. As shown in Table 8-3, all four Lagrange multipliers display significant effects, indicating spatial autocorrelation in both the dependent variable and the error term of the OLS regression. Therefore, both SLM and SEM models should be built according to the specified criteria.

Table 8-3 Lagrange multiplier diagnostics for spatial dependence in regressions.

Lagrange multiplier diagnostics	**Pre-lockdown**		**First lockdown lifted**		**Post-lockdown**	
	statistic	p value	statistic	p value	statistic	p value
Moran's I statistic standard deviate	43.450	0.000	29.390	0.000	28.200	0.000
LMerr	1817.964	0.000	826.259	0.000	760.115	0.000
LMlag	2096.935	0.000	933.438	0.000	873.836	0.000
RLMerr	51.106	0.000	10.081	0.001	10.248	0.001
RLMlag	330.078	0.000	117.260	0.000	123.969	0.000

The regression results of standardised coefficients, standard errors and model evaluations of OLS, SLM and SEM are shown in Table 8-4. SLM and SEM have around 7.8% improvement in R-Squared with respect to OLS in pre-lockdown and have around 3% improvement in first lockdown lifted and post-lockdown models. The AIC values of spatial models are lower than OLS, from which it can be determined that spatial models have superior goodness-of-fit and SLM is slightly better than SEM in terms of AIC. The spatial lag and spatial error terms in all three periods are significant, suggesting that the spatial dependence in dependent variables and error terms were consistently present and did not disappear in response to the lockdown.

Table 8-4 Results of regression for average monthly revenue per bedroom over three periods of the pandemic.

Variable	Pre-lockdown			First lockdown lifted			Post-lockdown		
	OLS	SLM	SEM	OLS	SLM	SEM	OLS	SLM	SEM
(Intercept)	0.000	0.000	0.001	0.000	0.000+	0.000	0.000	0.000	0.001
	(0.010)	(0.000)	(0.027)	(0.011)	(0.000)	(0.021)	(0.011)	(0.000)	(0.020)
Structural factors									

scale(Dwe_ModAge)	0.084***	0.037***	0.035**	0.063***	0.032**	0.033**	0.084***	0.053***	0.058***
	(0.010)	(0.010)	(0.011)	(0.012)	(0.010)	(0.012)	(0.012)	(0.011)	(0.012)
scale(OpenSpace_Pct)	0.018+	0.008	0.016	0.026*	0.012	0.016	0.036**	0.019+	0.025
	(0.010)	(0.010)	(0.015)	(0.011)	(0.007)	(0.016)	(0.011)	(0.010)	(0.016)
Neighbourhood amenities									
scale(Tour_Den)	0.048***	0.020*	0.019+	0.023+	0.012+	0.013	0.023+	0.011	0.012
	(0.011)	(0.009)	(0.010)	(0.012)	(0.007)	(0.012)	(0.012)	(0.011)	(0.012)
scale(Leisure_Den)	0.087***	0.044***	0.036**	0.033*	0.019	0.018	0.038**	0.023*	0.022
	(0.012)	(0.011)	(0.012)	(0.013)	(0.012)	(0.013)	(0.013)	(0.011)	(0.013)
scale(Shop_Den)	0.007	0.005	0.003	0.002	0.003+	0.003	0.012	0.013+	0.013
	(0.010)	(0.004)	(0.009)	(0.011)	(0.002)	(0.011)	(0.011)	(0.007)	(0.011)
Accessibility and location									
scale(PTALs)	0.182***	0.095***	0.115***	0.153***	0.102***	0.126***	0.149***	0.099***	0.124***
	(0.015)	(0.014)	(0.017)	(0.017)	(0.016)	(0.019)	(0.017)	(0.016)	(0.019)
scale(Dist_CBD)	−0.419***	−0.128***	−0.540***	−0.367***	−0.165***	−0.429***	−0.366***	−0.171***	−0.424***
	(0.016)	(0.016)	(0.031)	(0.018)	(0.019)	(0.027)	(0.018)	(0.020)	(0.026)
Socio-demographics									
scale(Pop_Den)	0.070***	0.005	−0.005	0.072***	0.027*	0.026+	0.057***	0.017	0.019
	(0.013)	(0.009)	(0.013)	(0.015)	(0.012)	(0.015)	(0.015)	(0.013)	(0.015)
scale(Ethnic_Pct)	−0.124***	−0.060***	−0.127***	−0.142***	−0.083***	−0.147***	−0.153***	−0.091***	−0.156***
	(0.013)	(0.014)	(0.022)	(0.015)	(0.014)	(0.021)	(0.015)	(0.014)	(0.021)
scale(PriRental_Pct)	0.060***	0.061***	0.057***	0.059***	0.060***	0.060***	0.076***	0.074***	0.075***
	(0.013)	(0.012)	(0.014)	(0.014)	(0.013)	(0.016)	(0.014)	(0.014)	(0.015)
scale(Homeworker_Pct)	0.138***	0.058+	0.065**	0.129***	0.073***	0.088***	0.144***	0.083***	0.098***
	(0.018)	(0.034)	(0.022)	(0.020)	(0.018)	(0.024)	(0.020)	(0.019)	(0.024)
scale(Mean_Income)	0.040*	0.013	0.003	0.060**	0.038*	0.031	0.056**	0.038*	0.036
	(0.018)	(0.039)	(0.021)	(0.021)	(0.016)	(0.024)	(0.020)	(0.019)	(0.024)
rho		0.632***			0.484***			0.471***	
		(0.021)			(0.027)			(0.027)	
lambda			0.685***			0.499***			0.482***
			(0.021)			(0.032)			(0.031)
Num.Obs.	4835	4835	4835	4835	4835	4835	4835	4835	4835
R2	0.535	0.613	0.605	0.426	0.457	0.452	0.437	0.466	0.460
R2 Adj.	0.552			0.425			0.436		
AIC	9850.7	9162.8	9256.9	11061.6	10794.4	10846.5	10967.6	10716.2	10775.2

F	497.915	298.585	312.343

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001; coefficients are standardised by z-score; standard errors are in parentheses.

Among the influencing factors, the marginal contributions of neighbourhood amenities and socio-demographics exhibit large differences while structural and location variables perform consistently across models and time periods. Here the sign of coefficients estimated by OLS is mostly consistent with SLM and SEM, but the magnitude varies, which effectively validates the observation of autocorrelated impacts of Airbnb listings revenue and the error term in surrounding neighbourhoods during different pandemic periods.

Prior to the lockdown, neighbourhoods with a higher concentration of recently constructed properties (SLM: β=0.037, p<0.001), of which much of Central London falls into this group, captured more gains than neighbourhoods with higher concentrations of older dwellings. The association of public parks with Airbnb revenue was found to be non-significant in SLM (β=0.008, p>0.1). In addition, neighbourhood Airbnb revenues were significantly associated with the density of pubs (SLM: β=0.044, p<0.001) and less significantly associated with other tourist attractions (SLM: β=0.020, p<0.05). However, retail shop density was found not to be significant (SLM: β=0.005, p>0.1).

For transport and location factors, both public transport accessibility (SLM: β=0.095, p<0.001) and proximity to the city centre (SLM: β=-0.128, p<0.001) exhibit a significant positive contribution to revenue (also see Deboosere et al., 2019). For socio-demographic factors, population density (OLS: β=0.070, p<0.001; SLM: β=0.005, p>0.1; SEM: β<-0.005, p>0.1) and local income levels (OLS: β=0.040, p<0.05; SLM: β=0.013, p>0.1; SEM: β=0.003, p>0.1) were positively related to Airbnb revenue in OLS, but the coefficients were no longer significant after controlling spatial interactions. This indicates that the population agglomeration and wealth effects on local short-term rental revenues are not significant and derives more from the spatial dependency effects of short-term rental activities in surrounding neighbourhoods and unmeasured variables.

The three models are consistent in demonstrating that the proportion of white populations (OLS: β=-0.124, p<0.001; SLM: β=-0.060, p<0.001; SEM: β=-0.127, p<0.001), the proportion of private rental housing units (OLS: β=0.060, p<0.001; SLM: β=0.061, p<0.001; SEM: β=0.057, p<0.001) and the percent of people work from home (OLS: β=0.138, p<0.001; SLM: β=0.058, p<0.1; SEM: β=0.065, p<0.01) had a particularly positive and significant relation to Airbnb revenue.

After the first lockdown was lifted, the positive associations of tourist attractions (SLM: β=0.012, p<0.1) and leisure facilities (SLM: β=0.019, p>0.1) with Airbnb host revenue declined significantly, which suggests the significant impact by the first lockdown on short-term rental activities near attractions and leisure sites. In contrast, the impact of retail shops remained low (SLM: β=0.003, p<0.1).

However, accessibility and locational factors continued to have significant associations with Airbnb revenue.

The impact of the proportion of home workers (SLM: β=0.073, p<0.001), non-white population (SLM: β=-0.083, p<0.001) and private rental units (SLM: β=0.060, p<0.001) of the LSOA were largely consistent with those before the first lockdown. However, the impact of neighbourhood population density (SLM: β=0.027, p<0.05) and average income (SLM: β=0.038, p<0.05) became significant, which comes from the fact that revenues decreased in less densely populated areas and concentrated in a few higher income areas. These suggest spatially heterogeneous effects of the lockdown on the Airbnb market.

After the third lockdown, there were notable changes with the previous two periods. The impacts of the two structural factors are strengthened. The density of tourist attractions (SLM: β=0.011, p>0.1) became non-significant with host earnings. This indicates that short-term rentals in tourism areas had not rebounded after the third lockdown. Leisure facilities (SLM: β=0.023, p<0.05) regained significant impact and retail shops (SLM: β=0.013, p<0.1) showed signs of increasing importance relative to other dimensions. The marginal contribution of proximity to the centre (SLM: β=-0.171, p<0.001) and public transport accessibility (SLM: β=0.099, p<0.001) maintained their positive significant effects on revenue in all three periods. In terms of socio-demographic factors, the magnitude of the effect of population density (SLM: β=0.017, p>0.1) on revenues returned to its pre-pandemic non-significance while the association between Airbnb revenue and neighbourhood income levels (SLM: β=0.038, p<0.05) persisted. Notably, the revenue gap widened between LSOAs with high and low proportions of non-white populations (SLM: β=-0.091, p<0.001). Furthermore, neighbourhoods with a previously high proportion of private rental units (SLM: β=0.074, p<0.001) enhanced their Airbnb operations, producing a larger revenue gap across space than before the first pandemic lockdown. Thus, in the post-pandemic era, short-term rental activities remained stubbornly entrenched in existing strongholds.

8.4.1 Unpacking the spatial spillover effects on Airbnb revenue

Given the relatively robust estimation of the SLM, it proceeds to dissect its spatial effects, considering the direct, indirect, and overall effects of each explanatory variable on Airbnb revenue (Table 8-5). The direct effect estimates closely resemble the corresponding coefficients in Table 8-4, while the indirect effects capture spatial spillover effects, with their sum representing the total effect.

Table 8-5 Results for direct, indirect and total effects over three periods of the pandemic.

Variable	Pre-lockdown			First lockdown lifted			Post-lockdown		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total

scale(Dwe_ModAge)	0.039 ***	0.060 ***	0.099 ***	0.034 ***	0.029 ***	0.063 ***	0.055 ***	0.045 ***	0.100 ***
scale(OpenSpace_Pct)	0.008	0.013	0.021	0.012	0.011	0.023	0.019 *	0.016 *	0.035 *
scale(Tour_Den)	0.022 **	0.033 **	0.055 **	0.012 *	0.010 *	0.023 *	0.011	0.009	0.021
scale(Leisure_Den)	0.047 ***	0.073 ***	0.120 ***	0.019	0.017	0.036	0.024 **	0.019 **	0.043 **
scale(Shop_Den)	0.005	0.008	0.014	0.003	0.002	0.005	0.013 *	0.011	0.024
scale(PTALs)	0.102 ***	0.157 ***	0.259 ***	0.106 ***	0.091 ***	0.197 ***	0.103 ***	0.084 ***	0.188 ***
scale(Dist_CBD)	-0.136 ***	-0.210 ***	-0.347 ***	-0.172 ***	-0.149 ***	-0.321 ***	-0.178 ***	-0.145 ***	-0.323 ***
scale(Pop_Den)	0.005	0.008	0.014	0.029 **	0.025 **	0.053 **	0.018	0.015	0.033
scale(Ethnic_Pct)	-0.064 ***	-0.098 ***	-0.162 ***	-0.087 ***	-0.075 ***	-0.161 ***	-0.095 ***	-0.078 ***	-0.172 ***
scale(PriRental_Pct)	0.065 ***	0.100 ***	0.165 ***	0.062 ***	0.054 ***	0.116 ***	0.077 ***	0.063 ***	0.140 ***
scale(Homeworker_Pct)	0.062 *	0.095 *	0.157 *	0.076 ***	0.065 ***	0.141 ***	0.086 ***	0.070 ***	0.157 ***
scale(Mean_Income)	0.014	0.022	0.036	0.039 **	0.034 **	0.073 **	0.040 **	0.032 *	0.072 **

Note: Sig-level * p<0.1, ** p<0.05, and *** p<0.01.

As observed, proximity to location factors has the largest direct and indirect effects, but their spatial spillover effects declined after first lockdown lifted and did not rebound after the third lockdown. The spatial spillover of Airbnb revenue in areas with a formerly higher proportion of private rental and home workers had a sharp decline after the first lockdown but showed some recovery after the third lockdown. Conversely, reductions in spatial spillovers occurred around tourist attractions (from 0.033 to 0.01) and leisure facilities (from 0.073 to 0.017), with negligible recovery thereafter. As lockdowns eased, spatial spillover effects grew increasingly prominent in more affluent neighbourhoods boasting more abundant green space and activity hubs. In summary, the spatial econometrics expose a dynamic redistribution of Airbnb externalities across lockdown transitions, shifting from traditional transportation nodes and tourist sites towards more affluent neighbourhoods.

8.4.2 Neighbourhood Deprivation and Patterns of Airbnb

The previous analysis reveals a discernible pattern of widening revenue disparities in the aftermath of COVID-19. These divergences might be reproduced by the confluence of deprivation intertwined with economic opportunities. This

led to further examination of the relationship between unexplained Airbnb revenues and IMD, unveiling substantial between-group heterogeneity.

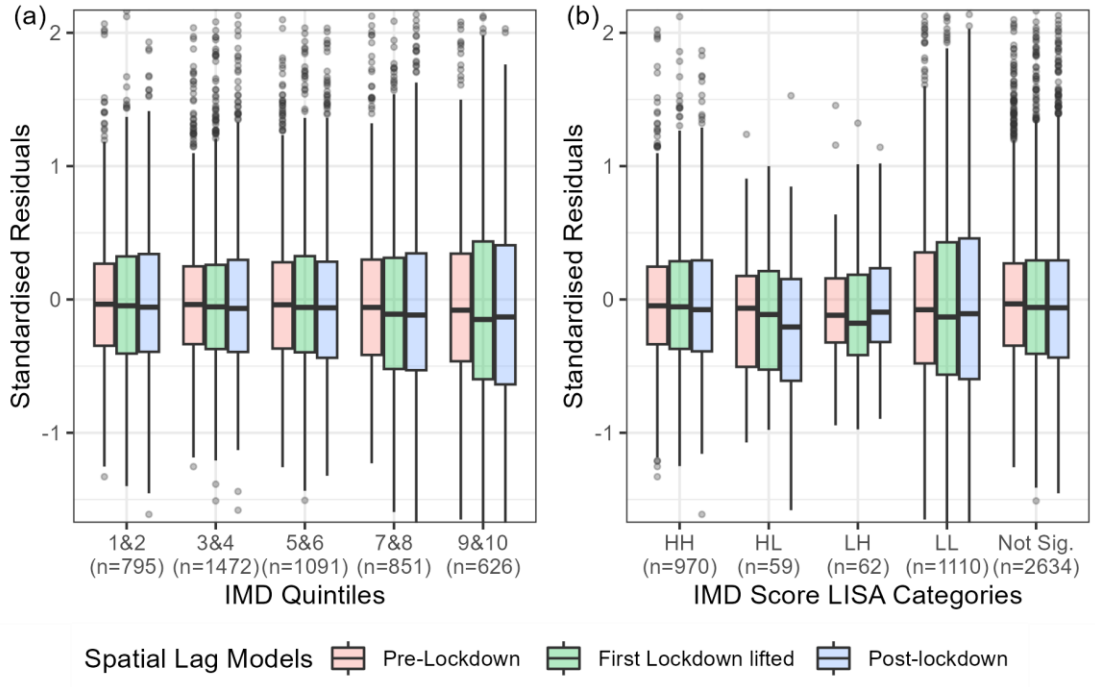


Figure 8-4 The boxplots for residuals of pre-lockdown, after first lockdown lifted and post lockdown period spatial lag models in each IMD quintile group and IMD score LISA category. (Own elaboration)

Figure 8-4 illustrates the distribution of residuals, or unexplained Airbnb revenue. Almost all IMD quintile groups exhibited varying degrees of attenuation following lockdown measures. Simultaneously, each quintile group evidenced an elevated interquartile range extending beyond the pre-lockdown period, particularly in less deprived clusters. This suggests a broadening disparity in revenue outcomes within each quintile. Less deprived areas underwent the most notable median residual decline prior to the first lockdown, with a noticeable polarisation in the interquartile range. On the contrary, the residual distribution of more deprived groups experienced a consistent, albeit minor, reduction across three periods with the decline being more pronounced in areas surrounded by less-deprived neighbourhoods. Despite experiencing greater volatility during the pandemic, less deprived areas appear to have recovered more rapidly, regardless of whether they are in L-L or L-H clusters, whereas more deprived areas suffered from a sequential decrease in median residuals. Airbnb revenues appear to be still concentrated in these less deprived neighbourhoods, suggesting heightened vulnerability to lockdown policies in deprived areas and potential exposure to gentrifying tendencies (see also Deboosere et al., 2019).

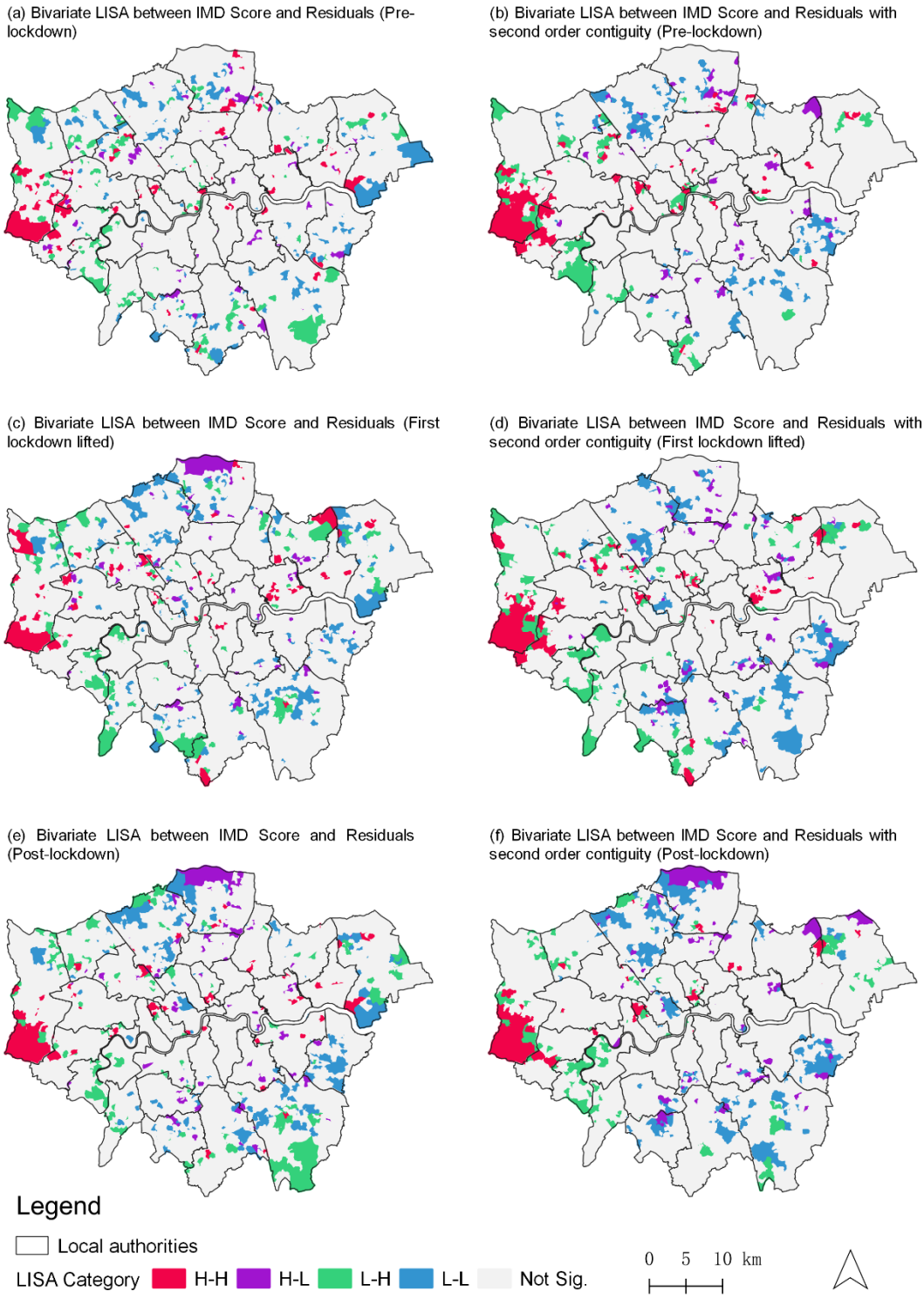


Figure 8-5 The bivariate LISA analysis between IMD Score and residuals of pre-lockdown, after first lockdown lifted and post lockdown period spatial lag models with Queen's first and second order contiguity. (Own elaboration)

When taking spatial context between deprivation and revenue level into account (shown in Figure 8-5), H-H clusters, representing deprived neighbourhoods surrounded by high Airbnb revenues, were observed in the inner and west end of

Greater London. Their locations varied after the first lockdown but re-emerged in the core city in the period following the third lockdown. Some sporadic H-L clusters, representing deprived areas surrounded by low Airbnb revenues, were observed in the suburbs, and this trend did not reverse when the third lockdown ended. L-H clusters expanded in the outer suburbs of East and West London after the first lockdown, reflecting the growing appeal of isolated environments during the pandemic. The expansion of L-L clusters in the northern and southern outer suburbs is indicative of a degree of resistance to Airbnb in the outer suburbs. These bivariate LISA analyses reveal that both H-H and L-H clusters are entrenched in the central and western part of London, reflective of sustained concentration of Airbnb across the three pandemic periods.

8.5 Summary and Conclusion

This chapter explores the response of the Airbnb market to the shock of COVID-19. The findings of this study contribute to the understanding of the fluctuating market and short-term rental revenue trajectories during the COVID-19 pandemic and reveal several new insights into the performance of the Airbnb market in Greater London – a city-region recognised as experiencing "…. chronic housing shortage and popularity of Airbnb given its status as a major tourist and business travel destination" (Todd, Musah, & Cheshire, 2021, p. 209; see also Shabrina, Arcaute, & Batty, 2021) during the different phases of the pandemic.

First and perhaps expectedly, the impact of the first lockdown on Airbnb revenue was significant, with the effects of the second and third lockdowns diminishing as a 'steady state' of continued entrenchment effectively evolved. There is an overall reduction in Airbnb listings though, the decrease is more evident in central parts of the Capital (also found in Kourtit et al., 2022) where supply has increased notably in the years leading up to the pandemic. However, these changes have been relatively marginal when compared to the overall Airbnb stock that remains, which suggests a degree of entrenchment of Airbnb in central areas close to leisure hubs and existing transport infrastructure where there is an intense set of challenges around housing supply, housing diversity and neighbourhood-level vulnerabilities (Wachsmuth & Weisler, 2018; Deboosere et al., 2019; Lima, 2019; Morales-Pérez, Garay, & Wilson, 2020; Shabrina, Arcaute, & Batty, 2021).

Second, professional hosts, specifically multi-listing and super-hosts, demonstrating relative agility in the face of the challenges posed at the onset of the first lockdown (Dolnicar & Zare, 2020). They exhibited a tendency to minimise losses and adjust their strategies (Llaneza Hesse & Raya Vílchez, 2022; Hu & Lee, 2020) for entering and exiting the short-term rental market as the pandemic unfolded, particularly during the first lockdown. In contrast, single listing hosts, who were primarily amateurs, were more inclined to exit the market as pandemic's

scale became clearer. After the first lockdown was lifted, there was a notable decrease in both the quantity and associated revenues as demand contracted, especially among multi-listing hosts. Many areas experienced drops in property values due to economic uncertainty, impacting investment decisions for hosts with multiple listings. Additionally, it is noted that super-hosts may have lagged behind ordinary hosts in exiting the market for the sake of their reputation for long-running properties. The analysis indicates that lockdown had a significant impact on Airbnb yields, where the majority of neighbourhoods within each sub-region experienced a spatially contagious decline in yields (see Sainaghi & Chica-Olmo, 2022).

In contrast, the end of the second lockdown did not lead to a less significant entry or exit of hosts from the short-term rental market, but rather invoked a 'wait-and-see' response. While the proportion of multi-listing hosts showed some signs of recovery, this was only a small rebound with the brief lifting of the second lockdown. The third lockdown, while also having an impact on host short-term rentals in some areas, seemingly had a lesser impact than the first lockdown. In the post-pandemic period, a significant loss of multi-listing hosts in areas with a concentration of Airbnb properties was found, reflecting differential responses of professional hosts to the pandemic (see Nhamo, Dube, & Chikodzi, 2020; Agustín Cocola-Gant et al., 2021; Boto-García, 2022). Meanwhile, some hotels faced significant operational and financial challenges, while Airbnb's diverse portfolio and adaptability appeared poised for a quicker recovery, potentially affording it a competitive edge over conventional tourist accommodations in the aftermath of the pandemic.

Third, prior to the introduction of the first lockdown, high-revenue neighbourhoods were associated with mature leisure and tourist destinations. In the post-lockdown era, there was a degree of dispersion of high-yielding neighbourhoods outwards into the suburbs (Liang et al., 2021; Airbnb, 2022a; also see Kourtit et al., 2022) and towards upscale residential areas. The deprivation gap plays a role in this shift, as Airbnb hosts adapted to optimise profits while those less engaged encountered challenges.

Here Airbnb revenue and its spatial spillover effects had varied association with variable locations, amenities, structural, and socio-demographic characteristics in different phases of the pandemic. Neighbourhood proximity to the city centre and transport accessibility consistently displayed robust positive correlations with short-term rental revenue throughout the pandemic, though with declining spatial spillover effects. Areas with higher concentrations of home working, self-employed workers, white population, and private landlords exhibit greater Airbnb listing concentration (also see Goyal, 2018; Janasz et al., 2022), a pattern that did not change before and after the lockdown periods, although their spatial spillover effects declined then partially recovered after the third lockdown.

Airbnb listings and revenues were found to concentrate in areas – especially in Central London – with higher proportions of newly constructed properties where listings and revenues remained entrenched. Airbnb users also demonstrated a growing preference for areas that offer convenient access to public parks and retail services with increased spatial spillover in the post-pandemic relative to the pre-pandemic period (Sainaghi & Chica-Olmo, 2022; Filieri et al., 2023). On top of that, the presence of high revenues surrounding certain deprived neighbourhoods in the central and western parts of London provides compelling evidence of the perpetuation of gentrification driven by Airbnb.

CHAPTER 9
CONCLUSION

9.1 Introduction

P2P accommodation platforms, such as Airbnb, have revolutionised the tourism industry by enabling travellers to rent in private homes and apartments instead of staying in hotels. However, these platforms also have significant impacts on urban spaces, local housing markets and communities, especially in areas where housing affordability and gentrification are pressing issues (Nieuwland & van Melik, 2018). The COVID-19 pandemic has further complicated the situation by disrupting the travel demand and affecting the supply and price of P2P rentals (Zhang et al., 2021; Sainaghi & Chica-Olmo, 2022). This study has aimed to investigate how P2P accommodation affects housing affordability and susceptibility to gentrification in different neighbourhoods, and how the P2P rental market responds to the pandemic-induced changes, especially in deprived neighbourhoods. This chapter offers concluding remarks, delves into the key research findings, and examines the policy implications arising from the study. The research extends its significance beyond theoretical advancements, positioning itself as a valuable resource for policymakers. The synthesis of research contributions, exploration of policy implications, and the proposal of recommendations form the central focus. Additionally, the chapter addresses the research's limitations and provides suggestions for future investigations.

9.2 Contributions of the research

9.2.1 Main findings

The originality of this thesis lies in several aspects. Initially, it discusses the development trends of shared accommodation in major UK cities from temporal and spatial dimensions to some extent, enriching the research content of the emerging accommodation products in the city under the sharing economy. Next, this study conceptualises the P2P tourist accommodation as a new form of gentrification and recalibrates the rent gap theory by integrating it into the framework. It also measures the P2P accommodation induced rent gaps from multiple perspectives, thereby enriching and developing the existing gentrification theory. On a technical level, the study, utilising an array of descriptive, geo-spatial, and quantitative methodologies in conjunction with Airbnb and housing big data, offers nuanced insights into the implications of P2P accommodation. At last, by summarising the measures adopted by major cities

worldwide and within the UK, it provides a valuable reference for subsequent urban planning and policymaking. This section synthesises the key findings of this research, addressing the outlined objectives and research questions.

Objective 1: Framework establishment

The first objective was to establish a framework linking rent gaps with the expansion of P2P accommodation. Our critical review of the literature indicates that the rise of P2P accommodation, particularly platforms like Airbnb, has been facilitated by broader financial trends that prioritise rental income as an asset class. The study revealed that financialisation has transformed housing into a commodity, where investment in P2P properties is driven by the potential for high returns. The research highlights that P2P accommodation contributes to rent gaps by perpetuating speculative financial practices, displacing long-term tenants, and leading to increased rents. This aligns with the theories of land rent and rent gap, demonstrating that the advent of P2P platforms acts as a catalyst for gentrification in urban settings.

Objective 2: Trends and spatio-temporal patterns of P2P accommodation

The second objective examined the development and impact of Airbnb in major UK cities from multiple perspectives, such as spatio-temporal characteristics, rent gap changes, and neighbourhood profiles. **Growing trends:** Airbnb listings have grown rapidly since 2015, especially in Greater London, where the scale and growth rate of whole properties are far ahead, posing serious risks to the housing and long-term rental market supply (Dogru, Mody, & Suess, 2019; Adamiak, 2022). The growth has slowed down in some areas due to competition and regulation. **Hot-spots of Airbnb growth:** Airbnb listings are generally concentrated in fast-growing central tourist areas, but also spread to the periphery of Greater London and Greater Manchester (Yang & Mao, 2019). Different city sizes have different spatial distribution patterns, with multi-core clusters in mega-cities, primary and secondary cores in medium-sized cities, and node-and-link development in small cities (Fang et al., 2020). **Rent gap creation:** there is a significant rent gap in all three cities, where the potential ground rent of Airbnb revenue exceeds the actual ground rent of long-term rental revenue in some neighbourhoods. The areas with the highest risk of gentrification are mainly tourist and central areas (Yrigoy, 2019; Amore, Bernardi, & Arvanitis, 2020). **Neighbourhood profiles:** International metropolises and student areas in the city centre, characterised by cultural and tourist attractions, internationalisation, and diversity, have the largest rent gap caused by Airbnb (Sigler & Wachsmuth, 2020). Here, Greater London and Greater Manchester tend to be dominated by cosmopolitanism, while Bristol is more dominated by students.

Objective 3: Impact on housing affordability

The third objective focused on the relationship between the professionalisation of P2P accommodation and the issues of housing affordability and gentrification. The penetration of professionalised Airbnb operating on a long-term basis can indeed affect neighbourhood housing prices, but the situation varies in different spaces. The spatial distribution of Airbnb's impact on housing prices in the three cities presents a pattern of decentralisation gradient. The central real estate market's stability limits rising potential, while suburban areas, with their limited housing stock, are more susceptible to Airbnb-induced scarcity effects. **Different types of Airbnb properties:** compared with house-type Airbnb, flat-type Airbnb has a greater impact on housing prices, but the impact of house-type Airbnb can be greater in some suburban neighbourhoods (Shabrina, Arcaute, & Batty, 2021). House-type can even have a greater negative impact on housing prices in city centre neighbourhoods (Cheung & Yiu, 2023). **Size of Airbnb units:** the penetration of smaller units Airbnb generally correlates with housing price appreciation in some suburban districts (Thackway et al., 2022). However, an uptick in such listings can impede long-term residency and foster gentrification. Alternatively, large-scale Airbnb operations tend to undermine social cohesion and stability (Cheung & Yiu, 2022). These patterns underscore the complex socio-spatial implications of Airbnb's suburban penetration. **Potential gentrification, displacement and Deprivation:** Airbnb gentrification is related to the increase in residential mobility, especially in central areas that are undergoing rapid socio-economic transformation and facing high migration pressure (Wang et al., 2023). These areas have a high mobility rate for low-income residents, who are forced to move out due to the influx of tourists and the loss of affordable housing. Moreover, the findings suggest that poverty makes families more prone to displacement. When Airbnb enters some deprived central areas, it brings more housing instability and insecurity to the surrounding residents.

Objective 4: Market response during COVID-19

Objective four investigated how the COVID-19 pandemic affected the P2P accommodation market. The response of the Airbnb market to the COVID-19 shocks within Greater London has been manifested in decrease in listings, exit of amateurs, attrition of multi-listing hosts, dispersion of high-income communities. **Overall impact:** The initial lockdown brought considerable disruption to Airbnb revenues, with the market partially adapting to subsequent lockdowns through the development of a 'steady state'. However, there has been a general decrease in the number of Airbnb listings, especially pronounced in the central parts of the capital (see also Kourtit et al., 2022). **Hosts strategies:** professional hosts, particularly those with multiple listings and 'superhosts', showed agility in responding to the

challenges brought by the initial lockdown, minimising losses and adjusting strategies for market entry and exit. In contrast, amateur hosts appeared more inclined to exit the market as the scale of the pandemic became clearer (Llaneza Hesse & Raya Vílchez, 2022; Hu & Lee, 2020). **Disruption to revenue generation:** prior to the initial lockdown, high-earning neighbourhoods were correlated with established leisure and tourist areas (Agustín Cocola-Gant et al., 2021). In the post-lockdown era, there is a dispersion of high-revenue communities towards suburbs and more upscale residential areas, as professional Airbnb hosts adapted to optimise profits while less-engaged hosts faced challenges (Nhamo, Dube, & Chikodzi, 2020; Boto-García, 2022). **Changes in revenue influencing factors:** diverse associations were found between Airbnb revenue and local neighbourhood characteristics at different stages of the pandemic. Well-connected areas with higher proportions of home working, self-employed workers, white population, and private landlords exhibit greater Airbnb listing concentration (also see Goyal, 2018; Janasz et al., 2022). After lockdowns, Airbnb listings and revenue remained concentrated in areas with a higher proportion of new builds, particularly in central London, and users showed a preference for areas with convenient access to parks and retail services (also see Sainaghi & Chica-Olmo, 2022; Filieri et al., 2023). Most notably, higher incomes around some impoverished communities in West London provided compelling evidence that Airbnb-driven gentrification is set to persist.

9.2.2 Contribution to the existing conceptual framework

Based on the phenomenon and existing conceptual frameworks, P2P short-term rental models have had a multifaceted impact on the accommodation and housing market. With respect to favourable impacts, such models contribute to the economy in tourist destinations, create new jobs and generate tax revenues. For landlords, P2P accommodation is a potential arena for micro-entrepreneurship, allowing individuals to generate additional income through the use of unused assets. For consumers, P2P accommodation services offer multiple competitive advantages over traditional hotel solutions, a wider choice of accommodation and a simplified booking and payment process. The P2P business model democratises the tourism industry, and tourists benefit from more competitive rates. Despite the benefits of P2P accommodation, it also raises concerns about the spatial impact of this economic model. Local residents may experience difficulties as a result, suffering from, for example, competition for houses and rising rents. In cities where P2P accommodation platforms are particularly popular, short-term rentals have severely squeezed the rental market at the time. By reducing transaction costs through peer-to-peer advantages, P2P accommodation has opened up the rent gap for many properties in tourist areas. The growth of tourism and the rapid opening of the rent gap have accelerated the process of housing financialisation by shifting

the housing stock to short-term rentals. This has led to gentrification in cities that were previously considered to have "no foundation" for such changes. In addition, the changing character of neighbourhoods with large numbers of non-residents and inconsiderate short-term visitors can threaten the well-being of local residents.

From our findings, professionalisation has played an increasingly prominent role in this process, with a large number of professional landlords and property management companies behind the rapid expansion of short-term rental platforms. Intermediaries and commercial operators have been able to acquire and control a substantial number of properties, and use the P2P platforms to offer short-term rentals expanding the impact of the platforms on the hospitality and housing markets. Professional players have transformed neighbourhood housing into 'short-term holiday homes' for tourism or leisure. P2P accommodation, through the financialisation of housing, enables the value deprivation and spatial displacement of the lower and middle class. Whether in developed economies or in the less economically developed countries, P2P platform technologies have linked local tourism real estate investment to capitalist globalisation. The increasingly flexible and effective business model provides a trading platform for local housing and external demand, stimulating transnational immigrants to use the tourism housing market as an asset to store surplus capital. Some transnational corporate investors and globalised professional landlords gradually replace local owners, accelerating the process of integrating urban rental housing into the global capital accumulation of the tourism industry. A 'buy-to-let investment' has further increased rental prices in central neighbourhoods and departed from the spirit of the sharing economy. This professionalisation process has promoted the creation of new forms of rent gaps, driving the mechanism by which tourism gentrification exploits rent gaps through the financialisation of urban housing and space.

The COVID-19 pandemic has severely crippled the exponential growth of P2P platforms, including Airbnb, in cities around the world, which has had a profound effect on the short-term rental market. From our research, professional investors exhibit a higher level of operational excellence than amateur hosts. They can dynamically price or convert vacant homes to other uses. Individual landlords are more vulnerable during pandemics due to their weaker financial base and usually less professional management skills. It is also because professional investors are more resilient, while the shock of COVID-19 served to 'disrupt the disruptor' (Dolnicar & Zare, 2020, p. 1), it did not de-stabilise existing geographies of Airbnb in the Capital, especially in Inner City, where Airbnb remains spatially entrenched and challenges around housing affordability and neighbourhood-level gentrification are acute(Shabrina, Arcaute, & Batty, 2021).

It can be said that the sharing economy has become a new reproduction mechanism of global financial capital. With the development of the sharing

economy, rental housing has become more closely aligned with a new type of financial asset. P2P accommodation platforms have rapidly formed a flexible way of producing/extracting “rent gaps” in urban communities, becoming the newest and most radical form of capital accumulation. Behind the platform urbanism represented by P2P accommodation is the process of global real estate capital promoting platform placemaking, housing financialisation and urban gentrification. P2P accommodation is becoming the main battleground for housing financialisation, leading a new wave of gentrification and enriching the existing framework of gentrification theory.

9.3 Potential implications and recommendations

The governance of P2P accommodations holds profound significance for both the theoretical discourse and the practical policymaking in fields such as tourism industry, housing system, and city planning (Nieuwland & van Melik, 2018). Through research, P2P accommodation in the UK indeed opens huge rent gaps, reduces housing availability and affordability and poses a threat to gentrification and displacement. Despite the disruption caused by the COVID-19 pandemic, the P2P accommodation market has shown notable resilience and a propensity to recover (Dolnicar & Zare, 2020; Gerwe, 2021), which is underpinned by its inherent adaptability and the on-going demand for flexible lodging solutions. Here, we have several recommendations as follows.

Develop a framework for the P2P short-term rental accommodation market that acknowledges its diverse spatial impact on different communities. This framework should differentiate based on the social and economic contexts of neighbourhoods (Wegmann & Jiao, 2017). In deprived areas where P2P accommodation brings income source, regulations could be more flexible, while in areas prone to housing scarcity and gentrification, more stringent controls – or 'regulatory interventions' – should be considered to preserve community integrity. In geographical areas riding the 'tourism wave', particularly those proximate to key tourist attractions, local authorities such as Westminster and Tower Hamlets in Greater London should give special attention to P2P accommodation and if needed could develop zoning regulations or permits for short-term rentals. To counter the gentrification risk in tourist and central areas cited in the study, mandating further investment in affordable housing, especially in areas of high risk, could be a viable strategy (Cheung & Yiu, 2022). Additionally, it might be necessary to impose restrictions on purchasers, preventing them from utilising these properties for short-term rentals.

Regularise and establish clear guidelines for professional hosts. The study highlights rapid growth in professionalised entire home listings, especially in Greater London, posing significant risks to the housing and long-term rental markets. Policies should not only look at neighbourhoods with high density of P2P

accommodations, but those professional hosts operating on a long-term basis or manage multiple listings (Gil & Sequera, 2020; Bosma, 2022). Beyond existing 90-day caps in Greater London, a robust policy might entail stricter limits on the number of days per year that a property can be rented out on P2P platforms and a regulated proportion of short-term rentals within any given area especially for entire properties (Li & Canelles, 2021). It may also include comprehensive registration and licensing requirements (Hübscher & Kallert, 2023). This would help to ensure that properties are not permanently converted into holiday rentals, preserving housing stock for residents.

P2P accommodation fits in better with smaller unit or flat dominated neighbourhoods, which is reflected through the rise in neighbourhood housing prices. To counter the affordable housing squeeze, initiatives could be crafted to discourage smaller flats from converting to short-term rental units which can be usually associated with price appreciation and gentrification (Shabrina, Arcaute, & Batty, 2021). On the other hand, in house-dominated neighbourhoods, the presence of P2P accommodation appears to depress property values. This indicates that house type short-term rentals impact the liveability of these communities, and it may necessitate community-building initiatives to foster social cohesion.

Touristification calls for a delicate equilibrium between its welfare and disruptions. After the pandemic, the implementation of tourist taxes could finance tourism infrastructure and contribute to a balanced visitor economy (Colomb & Moreira De Souza, 2021). Authorities should monitor the 'rent gap' and continually evaluate the intersection of P2P accommodation with the local housing market to ensure equitable competition. A progressive tourist tax, potentially using a tiered 'bed tax' structure on short-term rentals, can calibrate their distribution across varied neighbourhoods, thereby upholding social equity while harnessing economic benefits.

9.4 Limitations of the research

These research findings hold significant theoretical and practical implications for understanding the developmental dynamics of P2P accommodation, as well as its influence on urban spaces. Some beneficial conclusions were drawn, but there are areas in need of improvement.

Data deficiencies. As with other studies using online user-generated data, online property data is sometimes outdated or incomplete. Listings may not be regularly updated, certain properties may be missing from the dataset, and certain types of properties or transactions may be under-represented, leading to potential bias. Different websites may present data in a variety of formats, for example, Airbnb and Zoopla properties are not structured in a consistent manner (see also Table A-1), making it challenging to merge multiple sources of data, and therefore this paper is only able to examine this at a neighbourhood level, rather than at the

level of individual properties. Whilst some of the data is freely available, access to more detailed or comprehensive datasets often requires a fee, which may be a barrier for some researchers. Due to constraints in acquiring historical data, it is unable to delve into the development process since the emergence of P2P accommodation in the UK (Chaudhary, 2021). This may limit the understanding of the historical development and evolutionary patterns of P2P accommodation.

Measurement error. The existing literature on the rent gap does not propose a superior measurement. In this study, several different measurements have been tested to provide various perspectives. However, there is no consensus on which measurement is the most effective in measuring the rent gap between P2P accommodation and long-term rental markets (Wachsmuth & Weisler, 2018; Cansoy, 2018). The exploration of rent gaps was primarily from a spatial perspective, while a temporal perspective could potentially offer a different viewpoint, better linked to the developing trend of rent gaps.

Case selection and comparability. Only a few major cities in the UK were selected, which limits the understanding of more city development trends (Bei & Celata, 2023; Hübscher & Kallert, 2023). In the research, Airbnb was chosen as the main subject of the P2P accommodation study due to its representativeness. This might introduce a certain bias in the research results. Other P2P accommodation platforms such as HomeAway and VRBO also have their unique operating models and may have potential impacts on urban spaces (Wyman, Mothorpe, & McLeod, 2020). Additionally, the study summarises Airbnb listing counts through administrative divisions and a core-periphery framework. However, this approach might compromise comparability across different cities due to varying urban morphologies (Celata & Romano, 2022).

Repeat sales design. In the chapter on the impact of professionalised P2P accommodation on house prices, a repeat sales design is adopted and heterogeneity is explored using multi-level modelling. However, this combination is still in its nascent stage. It is unable to track changes in properties sold at different times, which could potentially introduce underlying estimation biases (Cannaday, Munneke, & Yang, 2005). On top of that, the study was conducted at the neighbourhood level, but it is uncertain if Airbnb penetration directly causes house price appreciation. There could be alternative methods to integrate the shock of Airbnb into the model. Moreover, identifying gentrification through quantitative methods always presents challenges. The number of factors intervening in this process is innumerable and cannot be directly measured (Chapple et al., 2021). This study uses general statistical methods to compare the relationship between different levels of gentrification and displacement and residential mobility but does not capture the complexity of their relationship at the household level.

Omitted variable and coverage. In examining the P2P accommodation market responses during COVID-19 pandemic, the direct effects of property structural attributes on revenue levels before, during and after lockdowns was not considered. Secondly, the focus only covers the period from January 2020 to April 2021. Extending this timeframe would enable further insights to be drawn about the response of the short-rental market in a longer-run post-COVID period. Third, the models employed here could be refined further, drawing in new covariates to compensate for omitted variable bias.

Nevertheless, the insights here are valuable in comprehensively revealing spatial and temporal patterns of the Airbnb market before and during the COVID-19 pandemic. The boom of P2P accommodation represented by Airbnb grew rapidly in the last decade, creating substantial rent gaps, particularly in international metropolises and diverse communities (Yrigoy, 2019; Cheung & Yiu, 2022). Long-term operating P2P accommodation has significantly decreased the housing availability and housing affordability in the neighbourhood, which potentially posed a threat to gentrification and displacement especially in deprived areas. While the COVID-19 has played a role in P2P accommodation, the challenges of housing affordability and neighbourhood-level gentrification caused by Airbnb remain significant.

9.5 Future research

P2P accommodation has immersed and transformed the fabric of residential neighbourhoods, recalibrating the economic dynamics at various spatial scales. The personal narratives, motivations, perceptions, and operational strategies of small-scale and large-scale landlords are pivotal in understanding how P2P accommodation navigates the interstices between public commerce and the private sphere. When their experiences are juxtaposed with tenants' attempts to sublet in secret, they form a complex tapestry of economic activity and regulatory challenges. The impact of these shifts prompted a comprehensive qualitative research investigation. Through interview and ethnographic methods, social scientists have the opportunity to delve into the lived experiences and subtleties of these market changes (Wachsmuth & Weisler, 2018). Engagement with this developing landscape provides valid support into neighbourhood gentrification and wider urban changes in the face of the expansion of the sharing economy.

P2P accommodation has profoundly influenced and transformed the fabric of residential neighbourhoods, recalibrating the economic dynamics at various spatial scales. The personal narratives and operational strategies of both small-scale and large-scale landlords are crucial in understanding how P2P accommodation navigates the boundary between public commerce and the private sphere (Lutz & Newlands, 2018). These gaps have prompted a comprehensive qualitative research investigation. Through interview and ethnographic methods,

social scientists have the opportunity to delve into the lived experiences and subtleties of these market changes. Engagement with this evolving landscape provides insightful support into neighbourhood gentrification and broader urban changes in the face of the expansion of the sharing economy.

To better understand the development of P2P accommodation in the UK since its inception, more historical data could be collected. This would allow for a more in-depth study of its historical development and evolution patterns, and space-time cube and emerging hot spot analysis could be applied to provide a quantitative measure as the basis for determining clusters and trends, specifically the temporal seasonality and the hot-spot change (Shabrina, Arcaute, & Batty, 2021). This would reveal seasonal changes of Airbnb and enhance the comparability between different cities. Future research could also consider the spatial pattern of individual Airbnb listing prices and the variation in its determinants. This could reveal subtle changes that may be overlooked when analysing at a broader spatial level.

P2P accommodation revenue and private rental revenue are estimated as proxies for potential ground rent and actual ground rent. However, a more robust measurement is needed to reflect market dynamics that represent the rent gap between P2P accommodation and long-term rental markets (Yrigoy, 2019). Further studies could investigate how rent gaps are influenced by external factors such as policy changes, economic fluctuations, and social movements. A cross-national comparison could also help assess the role of institutional and regulatory frameworks in moderating or exacerbating rent gaps.

One possible improvement for the repeat sales design is to track the changes in the properties sold at different times, such as the number of rooms, the quality of amenities, and the built environment. This would allow for a more accurate estimation of the impact of P2P accommodation on house prices. Additionally, geographically weighted regression model could be used to delineate the spatial heterogeneity and cross-validate it with the result of multi-level model.

There are avenues for further research towards the long-run post-COVID impact on P2P accommodation and gentrification. The models employed here could be refined further, drawing in new covariates to compensate for omitted variable bias. An alternative hedonic framework would likely reveal different insights to those generated here on the effect of the pandemic on Airbnb performance. This could also help to assess the long-term impact of COVID-19 on the demand and supply of P2P accommodation, and to evaluate the effectiveness of the policies and strategies adopted by the platforms, hosts, and governments (Filieri et al., 2023).

It's also worth looking forward to the future opportunities to study other platforms of P2P accommodation, in order to understand the development and impact of P2P accommodation more comprehensively and deeply. Such research

in this field should study the effects of these regulations and whether they were successful in reducing the gentrification pressures driven by Airbnb.

Appendices

Table A-1 Information of Property data collection.

Data Description	Risks of the Dataset
Airbnb listing data: Airbnb has an online platform that allows interaction between users. Users can become hosts by posting their property and key features, or guests in the short-term rental market by accessing the information. The platform shows the real-time availability of homes for short-term rentals, making various properties comparable. The data for the thesis comes from Inside Airbnb, an open source project created by housing activist Murray Cox, an active mission-driven project that aims to provide data quantifying the impact of short-term rentals on housing and residential neighbourhoods, and to create a platform to support policy advocacy. The project collects Airbnb information through web scraping regularly and the data on this site is licensed under a Creative Commons Attribution 4.0 International License and is therefore available for research purposes. Although web-scraped data has some sample flaws and ethical issues, it can still reflect the market conditions and be used for scientific research as long as it is reasonably processed, so many scholars have still studied the short-term rental market using Inside Airbnb data. The Inside Airbnb project data contains three main data sets. The main table contains all the profiles about all uniquely identified properties listed in Airbnb at that time, the reviews table contains the dates of all reviews for each property, and the calendar table provides an overview of price changes and availability for the coming year. The results from this thesis are primarily derived by analysing the main table. **Data Source:** InsideAirbnb.com **Data Range:** Greater London (2016-2021), Greater Manchester (2017-2019), Bristol (2017-2019).	1. The Inside Airbnb dataset primarily covers select urban areas that have significant Airbnb activity. This poses challenges for researchers wishing to generalise findings across different geographical contexts. 2. The data are snapshots of Airbnb listings at a particular time, so some Airbnb listings ever existed may not be included. 3. The dataset uses estimated availability for listings, which may not accurately reflect occupancy or availability. 4. For privacy reasons, the location of Airbnb data is obfuscated to random points within a 200 metre radius of the actual location of the listing. This limits the ability to perform detailed spatial analyses. 5. The presence of fake or duplicated listings and inactive advertisements can skew research findings. Therefore, significant data cleaning and preprocessing are often required before analysis.

Zoopla property data:

The Zoopla property dataset provides a comprehensive view of the UK property market. The dataset contains a variety of variables relating to residential property, such as property prices, rental values, transaction volumes and property characteristics (e.g. number of bedrooms, property type).

The data is collected from Zoopla's online property marketplace, which aggregates listings from various estate agents and private sellers. This ensures a robust and diverse dataset that reflects market dynamics across different regions and property types.

In addition to static property information, the dataset captures temporal changes in order to analyse trends over time. Researchers can use this rich dataset to explore property market fluctuations, assess the impact of economic factors on property values, and evaluate spatial patterns in property distribution. Here we mainly focus on the private rental market.

The dataset is curated and provided by the University of Glasgow's Centre for Big Urban Data, and researchers can access it by applying. Integration with urban research supports evidence-based decision-making, urban planning and socio-economic analyses, making it an invaluable resource for academics and policy makers.

Data Source: Urban Big Data Centre, the University of Glasgow.

Data Range: United Kingdom: 2010-2019.

1. Zoopla property dataset encompasses a vast array of property listings across the UK. This large volume of data necessitates significant computational power for storage, processing, and analytical tasks.
2. The presence of duplicated or fraudulent listings poses challenges for data integrity. Researchers must carefully assess the validity of listings to ensure that their analyses reflect the true state of the property market.
3. The dataset may contain logical inconsistencies, such as discrepancies between created dates, price change dates, and last marketed dates.
4. Given the complexities of the dataset, meticulous cleaning and preprocessing are essential before meaningful analysis can take place.

Land Registry Price Paid Data: The Land Registry's Prices Paid data provides a comprehensive database of residential property transactions within England and Wales. The dataset is essential for understanding the dynamics of the property market and is a key resource for researchers, policy makers and industry professionals. The dataset includes a detailed record of residential property sales, capturing essential information such as sale price, property type, transaction date and unique property identifier. As part of the UK Government's Open Data Programme, the Land Registry's paid price data is freely accessible, increasing transparency and encouraging data-driven research in housing economics and urban studies. **Data Source:** HM Land Registry **Data Range:** England and Wales (1995 to 2019).	1. The dataset does not contain information on the condition or refurbishment of the property, which can be an important factor in market value. 2. Inconsistent or incorrect entries may be present in the dataset, requiring careful data cleaning and validation. 3. Does not contain precise coordinate information, only postcodes and street addresses are included, for spatial analysis postcodes would need to be matched or addresses geocoded. 4. There may be delays in data release, which may impact the timeliness of analyses and insights. 5. The dataset is limited to residential transactions and does not include commercial property or mixed-use housing, in addition cash sales, properties sold at auction, and certain transfers (e.g., between family members) may also be excluded, which may limit insights into the overall market.

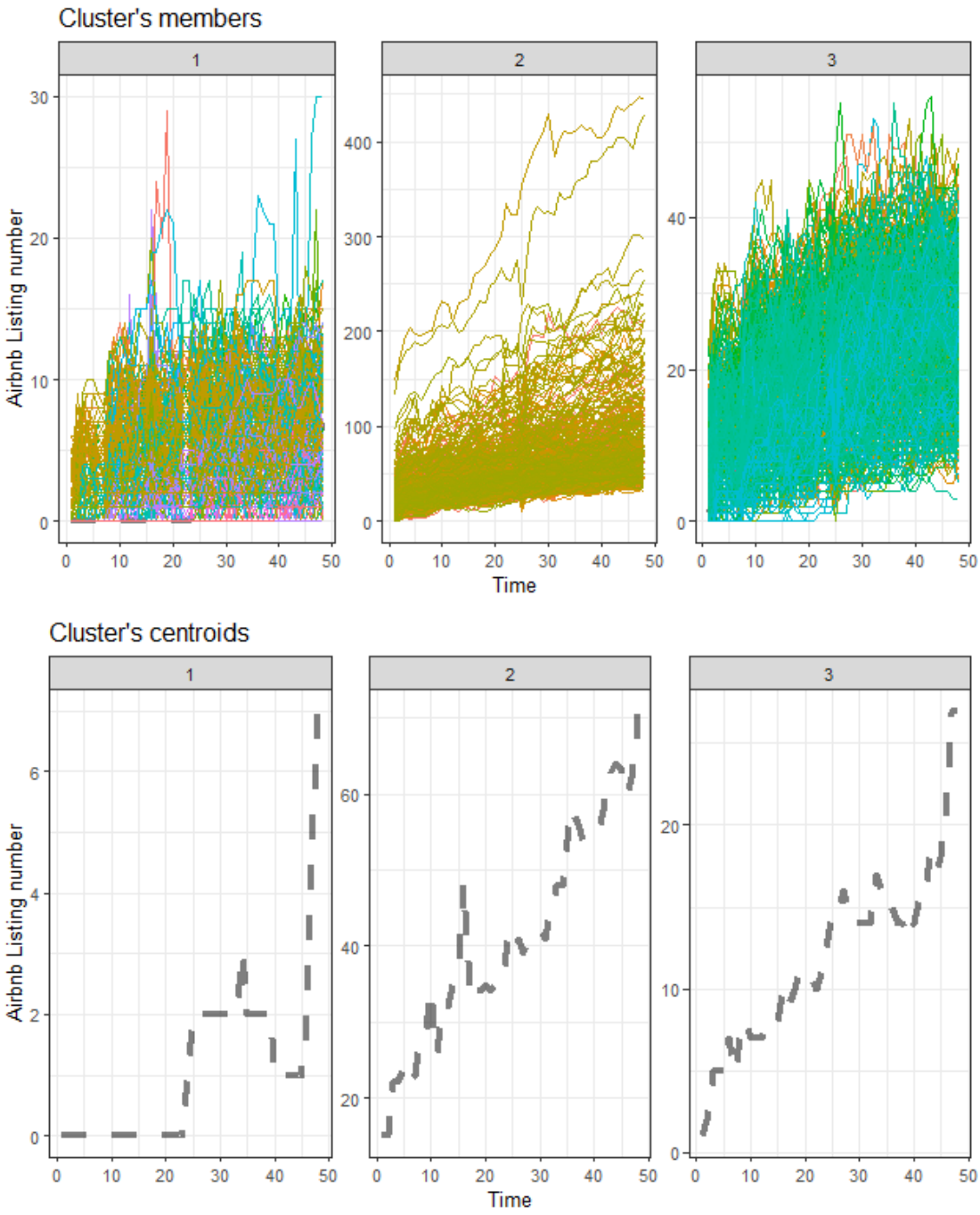


Figure A-1 The growth pattern clustering results of Greater London.

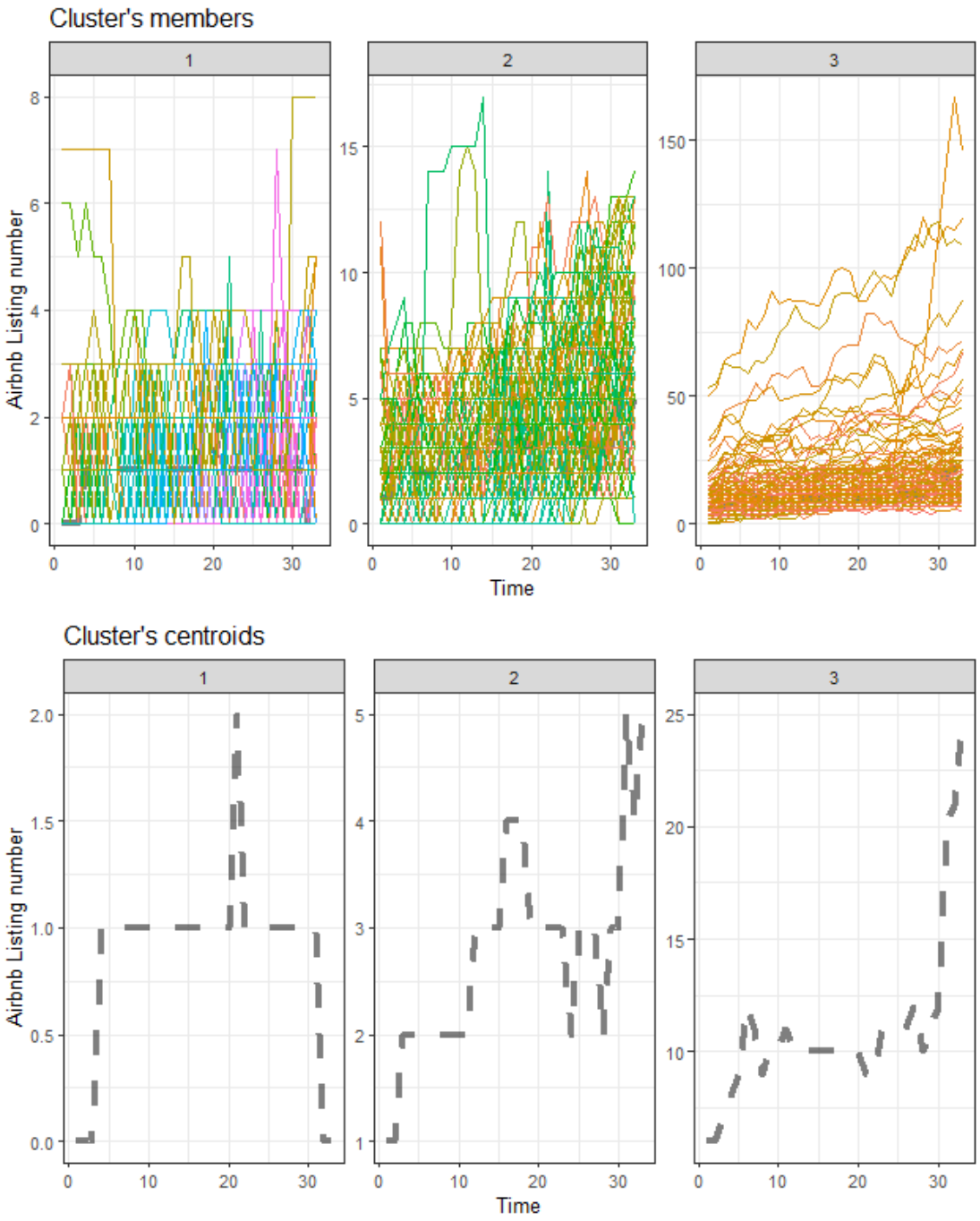


Figure A-2 The growth pattern clustering results of Greater Manchester.

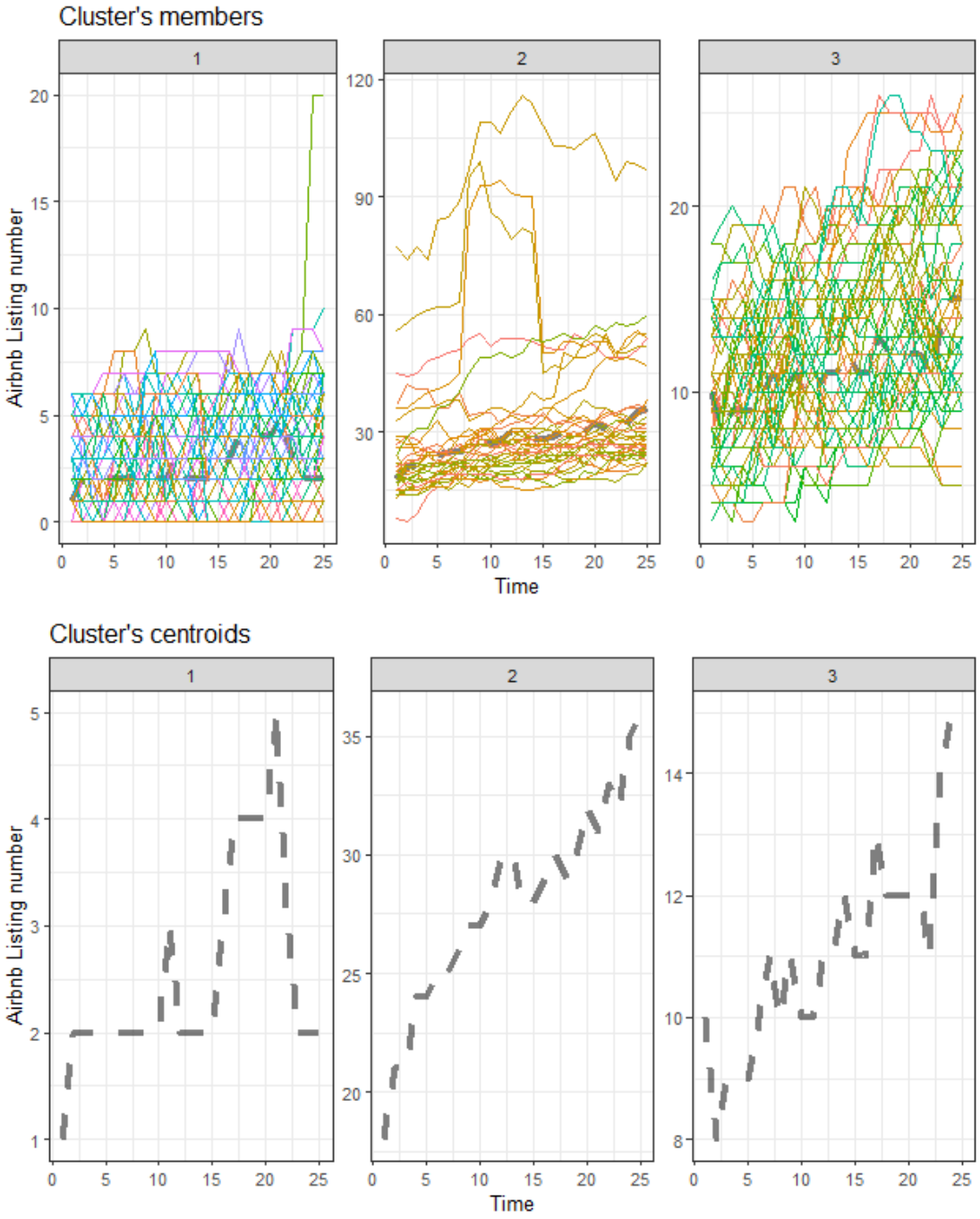


Figure A-3 The growth pattern clustering results of Bristol.

Table A-2 The definition of the core-periphery partition.

Region	Core Area	Description	Source
Greater London	Central Activities Zone	The Central Activities Zone covers London's geographic, economic and administrative core.	https://data.london.gov.uk/dataset/central_activities_zone https://www.london.gov.uk/programmes-strategies/planning/london-plan/past-versions-and-alterations-london-plan/london-plan-2016/london-plan-chapter-two-londons-places/policy-2
Greater Manchester	City centre	The extent of the city centre as confirmed by Manchester City Council, Salford City Council and TfGM, includes the whole of the area within Manchester's inner ring road, and also includes part of the administratively separate city of Salford and the area south of Oxford Road.	https://mappinggm.org.uk/your-city-centre/?lyrs=tfgm_ccts_city_centre_boundary/
Bristol	City centre	Bristol's city centre is the city's commercial, cultural, and business hub. It lies north of the River Avon's New Cut, and is bounded by Clifton Wood and Clifton to the northwest, Kingsdown and Cotham to the north, and St Pauls, Lawrence Hill, and St Phillip's Marsh to the east	https://bcc.maps.arcgis.com/apps/webappviewer/index.html?id=19dccec5f8c44a06b097974ad9f7b647

List of Abbreviations

Abbreviation	Definition
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
CBD	Central Business District
CDRC	Consumer Data Research Centre
DCMS	Department for Digital, Culture, Media and Sport
DTW	Dynamic Time Warping
ESRC	Economic and Social Research Council
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IMD	Index of Multiple Deprivation
LISA	Local Indicators of Spatial Association
LMERR	Lagrange Multiplier for Spatial Error Model
LMLAG	Lagrange Multiplier for Spatial Lag Model
LSOA	Lower Layer Super Output Area
MSOA	Middle Layer Super Output Area
OAC	Output Area Classification
OLS	Ordinary Least Squares
ONS	Office for National Statistics
OSE	Office of Special Enforcement
P2P	Peer-to-Peer
PAM	Partitioning Around Medoids
PAON	Primary Addressable Object Name
PTALs	Public Transport Accessibility Levels
REITs	Real Estate Investment Trusts
R-LMERR	Robust Lagrange Multiplier for Spatial Error Model
R-LMLAG	Robust Lagrange Multiplier for Spatial Lag Model
SAON	Secondary Addressable Object Name
SEM	Spatial Error Model
SLM	Spatial Lag Model
STR	Short-Term Rental
UNWTO	United Nations World Tourism Organization

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